Outline of two proposals for a maritime education and training scheme in Singapore: on the basis of a comparative study of selected national maritime education and training (concepts and) systems

Bin Sidin Ja'afar

World Maritime University

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OUTLINE OF TWO PROPOSALS FOR A NEW MARITIME EDUCATION AND TRAINING SCHEME IN SINGAPORE ON THE BASIS OF A COMPARATIVE STUDY OF SELECTED NATIONAL MARITIME EDUCATION AND TRAINING (CONCEPTS AND) SYSTEMS

by

Ja’afar Bin Sidin

Singapore

A paper submitted to the faculty of the World Maritime University in partial satisfaction of the requirements for the award of a

MASTER OF SCIENCE DEGREE

in

MARITIME EDUCATION AND TRAINING (NAUTICAL)

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

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OUTLINE OF TWO PROPOSALS FOR A NEW MARITIME EDUCATION AND TRAINING SCHEME IN SINGAPORE ON THE BASIS OF A COMPARATIVE STUDY OF SELECTED NATIONAL MARITIME EDUCATION AND TRAINING (CONCEPTS AND) SYSTEMS
For my parents,

my wife, Mariam and daughter, Nazaahah
Acknowledgements

I am deeply indebted to my assessor, Professor Gunther Zade, Vice Rector and Academic Dean for his indispensable guidance, support and encouragement throughout my work.

I wish to thank Captain R.D. Vardon, Head of Nautical Studies Department in the Singapore Polytechnic who co-assessed my work. I remain indebted to him for recommending me to study at the World Maritime University.

I am also indebted to the Patt Mansfield Endowment Fund for their generosity in sponsoring my studies. I am also grateful to the Singapore Polytechnic (my employer) and especially to the Principal, Mr. Khoo Kay Chai for the opportunity to study at the World Maritime University. I also like to thank my colleagues in the Singapore Polytechnic Department of Nautical Studies who in my absence have had to share the burden of work which I left behind.

My profound gratitude to many professors (both resident and visiting) and lecturers who were kind enough to discuss their views and help me with my project (thesis) and specially to: Professor Captain Hermann Kaps; Professor Captain Jens Froese, who read my writing on the dual-purpose scheme at the Hamburg Polytechnic and made some corrections; Professor Fyko Arbeider; the late Dr. Andrei Yakushenkov; Captain Stephen Cross and Captain Hans Van Walen. A very special thanks to my course professor, Professor Jef Mulders for his encouragement and effort in reading my work and for his views and suggestions. I am also
indebted to Captain D. M. Waters, former Principal of the Australian Maritime College and present Rector of the World Maritime University for reading my work and offering his suggestions for its improvement and for enlighting me on the background and development of MET in Australia.

Much of the materials for this project (thesis) especially with regard to Maritime Education and Training systems of various countries were collected from the many field studies undertaken by the course group. In this regard, I would like to thank the following institutions for providing me with information without which it would have been impossible for me to complete my work: Department of Nautical Studies, Bremen Polytechnic, FRG; School of Maritime Studies, Hamburg Polytechnic, FRG; Schleswig-Holsteinische Seemannsschule, Travemunde, FRG; The College of Maritime Studies, Warsash, U.K.; Admiral Makarov Higher Marine Engineering College, Leningrad, U.S.S.R.; Ecole Nationale de la Marine Marchande, Le Havre, France; Ecole Nationale de la Marine Marchande, St Malo, France; William Barentsz Nautical College, Terschelling, the Netherlands; The School of Navigation, Copenhagen, Denmark.

My sincere thanks and gratitudes to the following individuals and their organisations who responded immediately to my request for information: Professor Captain Jens Froese, Hamburg Polytechnic; Professor Captain Hermann Kaps, Bremen Polytechnic; Professor Loic Courcoux, Inspection Generale De L'Enseignement Maritime, Paris, France; Professor H. Kugumiya, Tokyo University of Mercantile Marine, Japan; Mr. Teh Kong Leong, Director of Marine, Singapore; Mr. Toh Ho Tay, Director, Fleet Management Division, NOL and Chairman of the Singapore Polytechnic Shipping Advisory
Committee; Mrs. G.C. Tan, National Maritime Board, Singapore; Ms. Loh Eng Geok, Ministry of Education, Singapore; Mr. Thomas Tay, Secretary-General, Singapore Maritime Officers Union and Dr. Paul Cheung, Director, Population Planning Unit, Ministry of Health, Singapore.

My special thanks also goes to Mr. Richard Poisson and all the library staff for their willingness and patience in responding to my request for assistance.

My deepest and most profound gratitude goes to my wife, Mariam and daughter, Nazaahah for their support and understanding.

Above all I thank God (Allah) for my health and His Inspiration and without His Will nothing is achievable.
Preface

This project (thesis) concentrates on Maritime Education and Training (MET) in Singapore. However, the proposals and findings contained in this project are applicable and useful to any country which is developing its MET or contemplating to restructure its existing one.

Having inherited its system from the United Kingdom and remaining virtually unchanged for nearly three decades, MET in Singapore is now at a crossroad. MET in Singapore is today experiencing a situation quite similar to that of the traditional maritime countries and in particular of Western European countries which since 1966 have had the problem to re-examine and restructure their MET systems to cope with new demands stemming from the changes in the industry and from new social and societal factors. In their endeavour to cope with these changes they have discarded outmoded ideas, devised new strategies and adopted new philosophies towards MET. Examples of changes stemming from these endeavours include the common entry for deck and engineering cadets, semi-integrated and/or fully-integrated education and training systems for ship officers and a curriculum which promotes professional (shipboard and ship-shore) mobility of ship officers.

The first two chapters set the scenario for MET in Singapore. Chapter One describes the historical developments of MET in Singapore and Chapter Two the existing MET for ship officers.

Chapter Three analyses the future demand for MET
in Singapore and its manpower supply and Chapter Four describes the pressures for change on the present MET system and their sources.

In Chapter Five an analysis of integrated MET systems of France and the Federal Republic of Germany (Hamburg Polytechnic), the semi-integrated MET systems of the United States (U.S. Merchant Marine Academy, Kings Point) and the Netherlands and the monovalent systems of Australia (Australian Maritime College) and the United States (U.S. Merchant Marine Academy, Kings Point) are made. Based on this analysis two conceptual proposals for the future MET in Singapore are made in Chapter Six.

Finally, Chapter Seven contains recommendations for implementation in Singapore.
## TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>i</td>
</tr>
<tr>
<td>PREFACE</td>
<td>iv</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>xi</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>xii</td>
</tr>
<tr>
<td><strong>CHAPTER ONE. HISTORICAL DEVELOPMENT OF MARITIME EDUCATION AND TRAINING IN SINGAPORE</strong></td>
<td>1</td>
</tr>
<tr>
<td>1.1 Development of MET in the Singapore Polytechnic</td>
<td>2</td>
</tr>
<tr>
<td>1.1.1 The period before 1960</td>
<td>4</td>
</tr>
<tr>
<td>1.1.2 The period from 1960 to 1970</td>
<td>6</td>
</tr>
<tr>
<td>1.1.3 The period from 1970 to 1980</td>
<td>7</td>
</tr>
<tr>
<td>1.1.4 The period from 1980 to 1990</td>
<td>9</td>
</tr>
<tr>
<td>1.2 Development of Ratings and Officers Training at the National Maritime Board</td>
<td>12</td>
</tr>
<tr>
<td>1.2.1 The period before 1973</td>
<td>13</td>
</tr>
<tr>
<td>1.2.2 The period from 1973 to 1980</td>
<td>15</td>
</tr>
<tr>
<td>1.2.3 The period from 1980 to 1990</td>
<td>16</td>
</tr>
<tr>
<td><strong>CHAPTER TWO. THE PRESENT STRUCTURE OF MET FOR MERCHANT NAVY OFFICERS</strong></td>
<td>19</td>
</tr>
<tr>
<td>2.1 The Training Schemes</td>
<td>21</td>
</tr>
<tr>
<td>2.1.1 The Diploma in Nautical Studies-Deck Cadet Training scheme</td>
<td>24</td>
</tr>
<tr>
<td>vi</td>
<td></td>
</tr>
</tbody>
</table>
2.1.2 Progression towards Deck Officer
Class 2 and Class 1 25
2.1.3 Additional qualifications 27

2.2 Diploma in Marine Engineering—Engineer Cadet Training Scheme 28

2.2.1 Progression towards Marine Engineer
Class 2 and Class 1 29
2.2.2 Watchkeeping Engineers Training
Scheme at NMB 29
2.2.3 Additional qualifications 32

CHAPTER THREE. OVERVIEW OF THE SINGAPORE SHIPPING INDUSTRY AND THE ANALYSIS OF MANPOWER NEEDS AND SUPPLY 33

3.1 Analysis of Manpower Needs 34

3.1.1 The Singapore Registry: growth and trend 34
3.1.2 Classification of ships by age 39
3.1.3 Shipowners/managers/agencies: Employment opportunities for shipboard personnel 42
3.1.4 Future growth of Singapore Registry 43
3.1.5 Analysis of demand 44

3.2 Analysis of Manpower Supply 46

3.2.1 Competition for GCE "O"-level school leavers 47
3.2.2 Analysis of supply 54

CHAPTER FOUR. PRESSURES FOR CHANGE IN THE MET SYSTEM 55
4.1 Domestic Pressures on the MET System and their Sources

4.1.1 The need to make MET attractive to Singapore's school leavers

4.1.2 The need to justify the cost of MET vis-a-vis the other disciplines in the Singapore Polytechnic

4.2 General Pressures and its Sources on the MET System

4.2.1 Technology and automation

4.2.2 Economics

4.2.3 Shipping environment

4.2.4 International Rules and Regulations

4.3 Necessary Response of MET

CHAPTER FIVE. COMPARATIVE STUDIES OF THE DUAL-PURPOSE AND MONOVALENT (DECK OFFICERS) SELECTED COUNTRIES

5.1 Introduction

5.1.1 USA - The U.S. Merchant Marine Academy, Kings Point, New York

5.1.2 France

5.1.3 The Netherlands

5.1.4 Federal Republic of Germany - Hamburg School of Maritime Studies

5.1.5 Australia - Australian Maritime College

5.2 Schooling and Academic Requirements for Entry into a Maritime Institution for the Highest Level of MET
5.3 Sequence of MET

5.3.1 Dual-Purpose Scheme
5.3.2 Monovalent (deck officers) scheme

5.4 Content of MET

5.4.1 Comparison of total teaching hours
5.4.2 Analysis by subject groups between the different countries
5.4.3 Analysis of subject groups within individual system

5.5 Organizational Shipboard Structure and Allocation of Regular Watch Hours Based Upon the Dual-Purpose Officers as Proposed by Some Countries

CHAPTER SIX. CONCEPTUAL OUTLINES OF TWO PROPOSALS RELATING TO A NEW MET SCHEME FOR SINGAPORE

6.1 Establishing the Right Objectives for the New MET

6.1.1 Identifying the different needs and demands
6.1.2 Harmonizing the different sets of needs and demands
6.1.3 Characteristics of the new MET system

6.2 Designing the New MET

6.2.1 Shore-based period
6.2.2 Entry requirements
6.2.3 The education structure
6.2.4 The philosophy 137
6.2.5 The scheme 140
6.2.6 The content 147

6.3 Concluding Remarks 157

CHAPTER SEVEN. RECOMMENDATIONS 160

7.1 Recommendations 160

7.1.1 Rationalising the use of scarce resources 160
7.1.2 "Apprenticeship Tax" scheme 161
7.1.3 A national approach towards education and training for the maritime industry 162
7.1.4 Providing education and training for the Singapore Navy 163
7.1.5 Simulators for training 164
7.1.6 Recognition for the academic qualification of the new MET diploma 165
7.1.7 Reduction in shipboard manning project 166
7.1.8 Staff qualifications 166
7.1.9 Co-operation with neighbouring country institutions 167
7.1.10 Harmonization of MET with neighbouring countries 168

BIBLIOGRAPHY xiv
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Tables</th>
<th>Page Nos</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1 Singapore Polytechnic, Diploma in Nautical Studies and Diploma in Marine Engineering Admission Requirements</td>
<td>23</td>
</tr>
<tr>
<td>2.2 Additional Qualifications</td>
<td>27</td>
</tr>
<tr>
<td>2.3 Additional Qualifications</td>
<td>32</td>
</tr>
<tr>
<td>3.1 Growth of Singapore Registry</td>
<td>35</td>
</tr>
<tr>
<td>3.2 Singapore Fleet by Age Group</td>
<td>40</td>
</tr>
<tr>
<td>3.3 Nos (thousands) of GCE &quot;O&quot;-Level School Leavers and their Distributions to Higher Institutes of Learning</td>
<td>49</td>
</tr>
<tr>
<td>3.4 Singapore Polytechnic Total First Year vs MET Courses Enrolment</td>
<td>50</td>
</tr>
<tr>
<td>4.1 Comparison in Rise of Wages</td>
<td>59</td>
</tr>
<tr>
<td>5.1 Main Subjects Required and Other Admission Requirements</td>
<td>87</td>
</tr>
<tr>
<td>6.1 Comparison of Total Teaching Hours Use by the Proposed Dual-Purpose Scheme with the Averaged Hours Use by USA, France, Netherlands and FRG</td>
<td>148</td>
</tr>
<tr>
<td>6.2 Comparison of Total Teaching Hours Use by the Proposed Monovalent (Deck Officers) Scheme with the Averaged Hours Use by the USA and Australia</td>
<td>153</td>
</tr>
</tbody>
</table>
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figures</th>
<th>Page Nos</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1 MET and Certification System (Deck Officers)</td>
<td>25</td>
</tr>
<tr>
<td>2.2 Ratings to Officers Certification System (Deck Officers)</td>
<td>26</td>
</tr>
<tr>
<td>2.3 MET and Certification System (Marine Engineers)</td>
<td>31</td>
</tr>
<tr>
<td>3.1 Growth of Singapore Fleet 1967-1979</td>
<td>36</td>
</tr>
<tr>
<td>3.2 Growth of Singapore Fleet 1980-1990</td>
<td>37</td>
</tr>
<tr>
<td>3.3 Trend in World Seaborne-Trade 1975-1988</td>
<td>38</td>
</tr>
<tr>
<td>3.4 Distribution of Singapore Fleet by Age Group (1 Jan '89)</td>
<td>41</td>
</tr>
<tr>
<td>3.5 GCE &quot;O&quot;-Level School Leavers and Distribution to Higher Institutions</td>
<td>51</td>
</tr>
<tr>
<td>3.6 Comparison of Singapore Polytechnic Total Enrolment and MET Courses Enrolment</td>
<td>53</td>
</tr>
<tr>
<td>4.1 Annual Rate of Population Growth</td>
<td>57</td>
</tr>
<tr>
<td>5.1 Primary and Post-Primary Education of New Entrants Joining the Highest Level MET in Each Country</td>
<td>89</td>
</tr>
<tr>
<td>5.2 Sequence of MET for the Dual-Purpose Schemes</td>
<td>91</td>
</tr>
<tr>
<td>5.3 Sequence of MET for Monovalent (Deck Officers) Scheme</td>
<td>95</td>
</tr>
<tr>
<td>5.4 Comparison of Total Teaching Hours Utilise by Each Country</td>
<td>98</td>
</tr>
<tr>
<td>5.5 Comparison of Total Teaching Hours Utilise for Each Subject Group by Each Country</td>
<td>102</td>
</tr>
<tr>
<td>5.6 Comparison of Total Teaching Hours Utilise for Each Subject Group by Each Country</td>
<td>105</td>
</tr>
<tr>
<td>5.7 Percentage Distribution of Subject Groups for Each Country</td>
<td>107</td>
</tr>
<tr>
<td>5.8 Content of MET (Dual-Purpose Scheme) in Selected Countries</td>
<td>111</td>
</tr>
<tr>
<td>5.9 Percentage Distribution of Subject Groups</td>
<td></td>
</tr>
<tr>
<td>Section</td>
<td>Page</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>5.10 Content of MET (Monovalent Scheme) in Selected Countries</td>
<td>115</td>
</tr>
<tr>
<td>5.11 FRG'S Future Organizational Shipboard Structure Based on SOD</td>
<td>118</td>
</tr>
<tr>
<td>5.12 Proposed Allocation of Regular Bridge Watch Hours and Additional Working Time Aboard</td>
<td>121</td>
</tr>
<tr>
<td>FRG'S Vessel Based on the SOD</td>
<td></td>
</tr>
<tr>
<td>5.13 The Netherlands Proposed Organizational Shipboard Structure Based on the Semi-Integrated Officers</td>
<td>122</td>
</tr>
<tr>
<td>5.14 The Netherlands Future Organizational Shipboard Structure Based on the Fully-Integrated Officers</td>
<td>124</td>
</tr>
<tr>
<td>5.15 Proposed Allocation of Regular Bridge Watch Hours and Additional Working Hours Aboard</td>
<td>125</td>
</tr>
<tr>
<td>Dutch Vessels Based on the Semi-Integrated Officers</td>
<td></td>
</tr>
<tr>
<td>5.16 Proposed Allocation of Regular Bridge Watch Hours and Additional Working Hours Aboard</td>
<td>126</td>
</tr>
<tr>
<td>Dutch Vessels Based on the Fully-Integrated Officers</td>
<td></td>
</tr>
<tr>
<td>6.1 Proposed Structure of Dual-Purpose Scheme</td>
<td>142</td>
</tr>
<tr>
<td>6.2 Proposed Structure of Monovalent (Deck Officers) Scheme</td>
<td>144</td>
</tr>
<tr>
<td>6.3 Percentage Distribution of Subject Groups in the Three-Year Shore-Based Studies of the Proposed Scheme (Dual-Purpose)</td>
<td>150</td>
</tr>
<tr>
<td>6.4 Percentage Distribution of Subject groups in the Shore-Based Diploma and Advanced Diploma Studies of the Proposed Scheme (Dual-Purpose)</td>
<td>151</td>
</tr>
<tr>
<td>6.5 Percentage Distribution of Subject Groups in the Three-Year Shore-Based Studies of the Proposed Scheme (Monovalent)</td>
<td>154</td>
</tr>
<tr>
<td>6.6 Percentage Distribution of Subject Groups in the Shore-Based Diploma and Advanced Diploma Studies of the Proposed Scheme (Monovalent)</td>
<td>155</td>
</tr>
</tbody>
</table>
CHAPTER ONE

HISTORICAL DEVELOPMENT OF MARITIME EDUCATION AND TRAINING IN SINGAPORE

Maritime Education and Training (MET) for merchant navy officers has been conducted in Singapore since the end of the second world war under the auspices of the Ministry of Education. Using borrowed premises, the courses were conducted as demand arose by an expatriate British merchant navy master. Notable among the premises was the now demolished Connell House situated in the city. Connell House was a seafarers club house mainly for European officers.

The examining body was the then Marine Division of the Ministry of Finance and the certificates issued were Singapore certificates. The Telecommunication Department was the examining body for the Radio Operators Licence.

Ratings training was also carried out and prior to 1956, in-service training was the only method whereby a person could become a seaman.

MET is today conducted at two institutions. The Singapore Polytechnic is mainly concerned with the maritime education and training of merchant navy officers and the National Maritime Board (NMB) for the training of ratings and watchkeeping engineer officers.
1.1 Development of MET in the Singapore Polytechnic

A summary of the main development in MET at the Singapore Polytechnic (SP) is listed below:

October 1954: The SP was established with the passing of the Singapore Polytechnic Ordinance by the Singapore Legislative Council.

January 1957: The SP took over responsibility for navigation and radio courses which were being conducted by the Ministry of Education at Connell House by the courtesy of the Sailor's Institute Committee.

1958/59: The Nautical Section as a division of the Department of Mechanical Engineering began conducting nautical courses at the Prince Edward campus.

The Nautical Section also looked after the training of marine engineers. A Diploma Course "A" was introduced as a common course for students preparing for Civil Engineering, Mechanical Engineering and Marine Engineering.

1959: Marine engineering courses were transferred to the newly formed Marine Engineering Division of the School of Engineering.

Radar Observer's Courses were introduced by the Nautical Section.

January 1960: The School of Nautical Studies was established. The first Pre-Sea Deck Cadet course was introduced.

Introduction of a two-year Wireless Telegraphy Competency Course.
1961: A four and one-half year Marine Engineering Cadet course was started.

1963: Marine engineering cadets sponsorship scheme was started.

1969: The School of Engineering was renamed School of Industrial Technology with a Marine Engineering Division.

1972: Radar Simulator Course was started by the school of Nautical Studies.

1973: A distance learning course was introduced for deck cadets.

1975: The Diploma in Marine Engineering course was modified from a "sandwiched" to a "front-loaded" scheme.

1978: The School of Nautical Studies introduced a Radar Interpretation and Plotting course to meet the Marine Department’s requirements for the issue of Home-Trade deck officers’ qualifications.

The School of Nautical Studies and the School of Industrial Technology became Departments of the SP.

1979: The one-year Pre-Sea Course for foreign-going deck cadets was shortened to a 16-week induction course.

Personal Survival courses was introduced by the Department of Nautical Studies to meet the Marine Department’s requirements for the issue of deck officer qualifications.
1980: Tanker Safety courses were introduced by the Department of Nautical Studies.

1981: The Department of Nautical Studies started a part-time course in transport studies. Formation of a Management Section in the department.

1982: Proficiency in Survival Craft and Shipboard Management courses were introduced by the Department of Nautical Studies.

A three-phase Diploma in Nautical Studies course for deck cadets was also introduced.

1983: The Marine Engineering Division became a department of the SP.

1984: Tanker Safety Technology and Management courses for marine engineers were introduced by the Department of Marine Engineering. Electronic Navigation System, Navigation Control, Crude Oil Washing and Inert Gas courses were introduced by the Department of Nautical Studies.

1985: A joint Singapore Armed Forces-SP Diploma scheme for marine engineers was introduced. Radio Officer training was abandoned and the Management Section of the Department of Nautical Studies was separated to form a new department.

1.1.1 The period before 1960

On 27 October 1954, the Singapore Polytechnic was established as an autonomous body with the passing of the Singapore Polytechnic Ordinance by the Singapore Legislative Council. The Prince Edward Campus was
officially opened by Prince Philip, the Duke of Edinburgh in 1959.

In January 1957, the Singapore Polytechnic took over the responsibility for navigation and radio courses which were being conducted by the Ministry of Education at Connell House by the courtesy of the Sailors Institute Committee. In 1958/59, the Nautical Section, as a division of the Mechanical Engineering Division began conducting radio operator courses and the following nautical courses at the newly completed Prince Edward campus:

- Master, First Mate and Second Mate F6
- Master and Mate Home-Trade
- Master and Mate Local-Trade
- Radar Observer
- Helmsmen

The Nautical Section also looked after the training of marine engineers.

A Diploma Course "A" was introduced as a common course for students preparing for Civil Engineering, Mechanical Engineering and Marine Engineering.

In 1959, Marine engineering courses which were conducted under the Nautical Section were transferred to Marine Engineering Division under the School of Engineering. However, the short courses for Part A and Part B of approximately 12 weeks for the 2nd and chief engineer certificate of competency continued to be conducted under the Nautical Section.

In the same year, the Nautical Section took over the Malay Local Trade Navigation Course which was conducted by the Ministry of Education.
Another milestone in the development of MET in the Singapore Polytechnic was the introduction of Radar Observer's courses in 1959 which were generally accepted in Commonwealth countries. A maximum of 10 students were accepted in each course—a condition for recognition by the United Kingdom.

The Radio Section which had been conducting its course for certificate of competence (2nd class) since 1957 had this course terminated in May 1959 to make way for further development. In the same year, two week courses for General Radio Telephony Certificate (International) were conducted.

1.1.2 The period from 1960 to 1970

In 1960, the School of Nautical Studies was established. In the same year equipment were purchased by the School of Nautical Studies and arrangements made for the start of a Pre-sea Training Course where young men of Singapore were trained before entering apprenticeship as deck officers of merchant vessels. The duration of the course was one year. Successful students were granted up to six months remission in the sea service requirements for a Second Mate Foreign-Going Certificate of Competency. Thus, sea-service requirement was reduced from three years and two months to two years and eight months.

In the same period, the Radio Section started a two year course towards Second and First Class Certificates of Wireless Telegraphy Competency as W/T operators with 30 students. Short courses were also held for serving Radio Operators to upgrade towards the Second and First Class Certificates for Radio Telephony General Certificates.
In 1961, a four and one-half year Marine Engineering Course was introduced.

In July 1962, Marine Radio Operators Conversion courses from Second Class to First Class were also conducted.

In 1963, the Marine Engineering Division implemented the "Alternative Scheme" for the training of marine engineers and for the first time incorporated the system of cadetship and sponsorship by shipping companies. The course consisted of Phase I and Phase II ashore with Phase III being sea-service aboard ships. This course lead to the award of Technician Diploma in Marine Engineering.

In 1969, the School of Engineering was renamed the School of Industrial Technology and the marine engineering courses continued to be taught under the Marine Engineering Division of the school.

1.1.3 The period from 1970 to 1980

In 1971, the Marine Engineering Division was renamed Marine Engineering and Shipbuilding Division which offered in addition a Diploma in Ship Construction (part-time day release course). In the same year, the Diploma in Marine Engineering course was modified and consisted of Phase I (two years ashore), Phase 2 (shipboard service) and Phase 3 (approved workshop practice). The award of the Diploma entitled the graduates from certain exemptions in the Part "B" Second Engineer Certificate of Competency (CoC) examinations.

In 1972, administration of the short courses for Part "A" and Part "B" CoC for marine engineers were transferred from the School of Nautical Studies to the
Marine Engineering and Shipbuilding Division and thus terminated all involvement of the School of Nautical Studies with marine engineering training.

In the same year, the School of Nautical Studies introduced the Radar Simulator Course. The course was in two parts, Part 1— Radar Plotting and Interpretation (5 days) and Part 2— Radar Simulator Training (5 days).

In 1973, a correspondence course was introduced by the School of Nautical Studies leading to the Second Mate Course. Cadets who completed the course were granted certain remission in sea-service.

In 1974, the Marine Engineering Diploma Scheme underwent further modification which consisted of — Phase 1 (two years shore-based), Phase 2 (one year sea-service + correspondence course) and Phase 3 (six months shore-based + six months approved workshop practice).

In the same year, the School of Nautical Studies introduced short courses for First Aid at Sea and the Shipmasters Medical Training Certificate courses. Successful completion of these courses were made mandatory for the award of a deck officer's CoC.

In 1975, the Diploma in Marine Engineering course was again modified so that the sea-service requirement would be at the end of the shore-based training rather than sandwiched as in the existing system. The new scheme consisted of, Phase 1 (two years shore-based study), Phase 2 (six months vacation training ashore + six months shore-based study) and Phase 3 (sea-service onboard).

In the academic year 76/77, the Singapore Polytechnic shifted to its new premises, the Princess Mary Campus at...
Dover Road at which remain to this day.

In 1978, the School of Nautical Studies started the Radar Interpretation and Plotting Course (two weeks) as a pre-requisite for the issue of the Master Home-trade and the Mate Home-trade CoC.

In the same year, the School of Nautical Studies and the School of Industrial Technology ceased to be schools within the Singapore Polytechnic and became two of its departments, the Department of Nautical Studies and the Department of Industrial Technology respectively. The Marine Engineering and Shipbuilding Division continued under the Department of Industrial Technology as one of its many divisions.

In 1979, the one year Pre-sea Course for foreign-going cadets was reduced to 16 weeks induction course. During this period, the Singapore fleet was at its largest and world seaborne trade was at its peak. Shipowners needed additional trained manpower urgently. Consequently, Captain Goh Choo Keng, then Director of Marine and Captain R.F. Short, then Head of the Department of Nautical Studies thought that the one year course was too long and expensive to sponsor by shipowners. A decision was then made to introduce the 16-week Pre-Sea Induction course as the first phase of a three-phase diploma course. In the same year, a compulsory two-day Personal Survival Course for all students was introduced.

1.1.4 The period from 1980 to 1990

In 1980 the Department of Nautical Studies further developed various short courses to meet requirements laid down by the Maritime Administration. These include the
the three-week Oil, Chemical and Liquefied Gas Tanker course which was made a pre-requisite for the issue of the CoC by the Marine Department. In the same year, the department stopped offering Local-trade Officer courses due to poor demand. The course was subsequently absorbed by the National Maritime Board which until then was only involved with rating training.

In 1981 for the first time the Department of Nautical Studies offered part time Chartered Institute of Transport tutorial courses of 36 weeks, evenings only. This can be seen as an attempt by the department to diversify into transport and eventually management courses and saw the formation of the Management Section within the department.

In 1982 the Department of Nautical Studies introduced the one week Proficiency in Survival Craft Course at the request of the Marine Department. A mandatory Shipboard Management Course (five days) for the First Mate and Master Foreign students was also introduced. In addition, a certificate in Shipping Management Course for managers and supervisors of maritime industry was introduced as a part-time evenings only course.

The 1982/83 academic year saw an attempt by the Department of Nautical Studies to provide some semblence of broader academic studies with the introduction of the Diploma in Nautical Studies Course for the deck cadets. Prior to this, the Department of Nautical Studies only awarded Pre-Sea Certificates. With the introduction of the Diploma scheme, the Department of Nautical Studies fell in line with the other departments in the Singapore Polytechnic which for some time had been awarding diplomas for their courses. However, unlike the other diplomas, the Diploma in Nautical Studies is a sandwiched
course alternating between shore-based, sea service and shore-based studies. The diploma scheme reduced the seatime requirement leading to the Second Mate CoC from three to two years. Unfortunately, the course had no accreditation and some perceived the diploma as being lower in value as a qualification for employment in shore-based maritime industry and for admission in institutes of higher learning is doubtful.

In 1983, the Marine Engineering and Shipbuilding Division became the Department of Marine Engineering and its shipbuilding courses transferred to the Ngee Ann Polytechnic. Short courses for engine drivers classes 3, 2 and 1, each of four weeks duration, were introduced (these courses are no longer conducted). A tanker safety course for marine engineers was also started.

1984 saw further development in short courses in the Department of Nautical Studies and the Department of Marine Engineering. These short courses include the Tanker Safety Technology and Management (marine engineers are now required to take the same Shipboard Management course as deck officers) for Marine Engineers Courses, Electronic Navigation Systems, Navigation Control and Crude Oil Washing and Inert Gas courses. The Electronic Navigation Systems and Navigation Control courses are mandatory for the award of Deck Officer Class 3 and Class 2 CoC respectively.

The Management Section of the Department of Nautical Studies saw the growth of its diploma and certificate courses with the introduction of the three year full time Diploma in Maritime Studies and a two year part time Certificate in Maritime Studies (Shipping Management).

In 1985 a further rationalisation of the Diploma in Marine Engineering took place. Phase I consist of three
year full time studies at the Singapore Polytechnic followed by Phase 2 of six months cadetship training aboard ships and correspondence course. The graduates obtained exemptions of both Part "A" of the Class 2 and Class 1 CoC examinations conducted by the Marine Department. The department also introduced a Basic Tanker Safety Course for shore-based engineers and personnel of shipping companies.

In 1986, a joint Singapore Armed Forces-Singapore Polytechnic Diploma scheme for marine engineers was started. These students are sponsored by the Singapore Navy into the marine engineering diploma course.

In the same year the Diploma in Maritime Studies (Shipping Management) course which were conducted in the evening only was introduced by the Department of Nautical Studies.

1986 also saw the end of Radio Officer training at the Singapore Polytechnic due to assumption that ships of the future will not require the present form of Radio Officers. In the same year also saw the separation of the Management Section from the Department of Nautical Studies for forming a new department.

1.2 Development of Ratings and Officer Training at the National Maritime Board (NMB).

A summary of the main development in MET at the NMB is listed below:

1956: Seafarers' Welfare Board (SWB) was established with responsibility for seafarers' training.

1964: The training ship T.S. "Singapore" was
commissioned. 12-week training courses for deck, engine and catering ratings were introduced.

1970: A General Purpose training for ratings was introduced.

1973: The National Maritime Board was established.

1978: Construction of the shore-based training school was started.

1979: Construction of the new training school was completed. The floating T.S. "Singapore" was sent for scrapping. Revision of all course syllabi and course structure as a result of the Standards of Training, Certification and Watchkeeping for Seafarers, (STCW) '78 Convention was done which resulted in all 12-week pre-sea courses being extended to 16 weeks.

1980: The new training school was officially opened. Retraining Courses for ratings were developed. Fire-fighting and Proficiency in Survival Craft courses were started.

1981: Watchkeeping Engineer Course (WEC) was introduced.

1989: Class 5 and Class 4 Deck Officers courses were introduced.

1.2.1 The period before 1973

Employment of seamen in Singapore has been carried out since 1912. The authority to regulate maritime employment was assigned to the Port Officer under Section 38(1) of the Merchant Shipping Ordinance, 1912. Up to
1956, in-service training was the only means whereby a person could acquire any knowledge of seamanship in order to become a qualified seaman (the term "seamen" in this context does not include officers). No formal shore-based training was needed nor provided.

In 1956, the Seafarers' Welfare Board (SWB) was established under an Ordinance and one of its responsibilities was training of seafarers. For this purpose, the SWB had a Training Sub-Committee which organised and supervised training programmes. In the same year a pilot training scheme for ship's steward was started and after this proved successful, the Government launched a basic training course for young men who wanted to go to sea in the rating grade.

On 16 May 1964, the training ship T.S. "Singapore" was formally commissioned by the then Deputy Prime Minister, Dr. Toh Chin Chye. The training courses were then administered by the SWB.

Facilities aboard T.S. "Singapore"

The T.S."Singapore" of 1900 GRT was the ex- Marudu formerly owned by the Straits Steamship Company Ltd and built at Belfast in 1924. She was 83.2m in length and 12.7m in breadth. The ship was purchased at S$160,000 and converted for training at a cost of S$192,000.

The facilities of T.S."Singapore" included accommodation for a maximum of 120 trainees, classroom, lifeboats, fully equipped engine room, generators, operational cargo holds, tanks, deck etc for basic pre-sea training. A small library and recreational facilities were also provided. The ship was initially anchored in the Eastern Anchorage but later it was berthed at Port of Singapore Authority Keppel Wharves.
The training scheme

The training scheme was drawn up by two experts from the Blue Funnel Line (UK). Training was provided in the Deck, Engine room and Catering departments. Each pre-sea course in the respective departments was of 12 weeks duration. All trainees had to undergo basic seamanship training and survival training in addition to specialist training in their respective departments.

Since 1964, the training scheme has undergone various changes and refinements. In 1970, a General Purpose (GP) system of training was introduced where Deck and Engine training was merged and trained to be dual-purpose. Successful trainees could opt to join either the GP department or the deck or the engine department of a ship. This form of training was discontinued a few years later because local employers did not implement GP crewing aboard the ships.

1.2.2 The period from 1973 to 1980

"The National Maritime Board was established on 1 Jan 1973 by the National Maritime Board Act, 1972. It absorbed and took over the functions of five statutory bodies dealing with matters relating to seafarers - the Singapore Sailors' Institute, Seamen's Registry Board, Singapore Mariners' Club, Seafarers' Welfare Board and the Seamen's Lodging Houses Licensing Authority.

The amalgamation of the five bodies into a single statutory authority was aimed at eliminating an overlap of functions between some of the bodies and to ensure that seafarer matters are better administered and
coordinated. [1]

The move to shore-based training

With the formation of the NMB, ratings training became more organised. By 1979 the T.S. "Singapore" produced over 5,000 trainees. However, the floating T.S. "Singapore" soon outgrew her capacity to support more facilities such as up-to-date equipment and classrooms. She was also very expensive to maintain. A decision was then made to move the training to shore-base. For this purpose, a 3.25 acre site was acquired at Sembawang within the Sembawang Army Camp and construction began in April 1978. The school was completed in Oct 1979 at a construction cost of S$3 million and a further S$1.2 million in new training equipment. The new school is renamed T.S. "Singapore". The floating T.S. "Singapore" was towed to the scrapping yard on 23 Oct 1979.

1.2.3 The period from 1980 to 1990

The new T.S. "Singapore" was officially opened by the then Minister for Communications and Labour, Mr. Ong Teng Cheong on 17 May 1980.

In setting up the training school, the NMB received assistance under the United Nations Development Programme (UNDP) in the form of consultancy services. The UNDP experts reviewed the syllabi and made recommendations for up-to-date equipment. New and upgrading courses were drawn up under their guidance. The UNDP project also provided for fellowships for local instructors to supplement the consultancy services by the foreign experts. Under these fellowships, senior teaching staff

of the school visited leading maritime training institutions in the UK and a few others in Western European countries.

Courses developed by NMB

The revision of all course syllabi and course structure by NMB was timely and coincided with the IMO Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), 1978.

The original 12-week pre-sea courses for deck, engine and catering were extended to 16 weeks to incorporate a 2-week orientation period where all trainees learn basic seamanship, firefighting and survival training techniques.

In the period between 1980 and 1981 various courses were introduced which include, Retraining Courses for deck and engineeroom ratings, Second Cook Course, Chief Steward Course, Fire-fighting Course and Proficiency in Survival Craft Course.

Following recommendations by the UNDP experts and also to ease the shortage of watchkeeping engineers, the Watchkeeping Engineer Course (WEC) was drawn up by a committee comprising representatives from the Marine Department, NMB, Neptune Orient Lines Ltd and the UNDP engine consultant expert. The training consisted of two phases. Phase 1, one year theoretical and workshop programme at school and Phase 2, one-year on-the-job training aboard sponsoring companies' ships. Additional staff was employed and new equipment purchased. The WEC also marked the beginning of NMB involvement with merchant officer training which up to then had been the primary concern of the Departments of Nautical Studies and Marine Engineering of the Singapore Polytechnic.
In December 1989, the NMB also took over the Class 5 and Class 4 Deck Officers courses which had been discarded by the Singapore Polytechnic as being too costly to run.
CHAPTER TWO

THE PRESENT STRUCTURE OF MET FOR MERCHANT NAVY OFFICERS

Analysis of the structure of the present form of MET in Singapore will bring out the following features:

1. The structure of MET for deck officers is presently "sandwiched" while MET for marine engineers is more "front-loaded". The Diploma in Marine Engineering completes all the shore-based theoretical studies up to the first Certificate of Competency (CoC) only. Thereafter, the students alternate between sea-service and short preparatory courses for their higher CoCs. The Diploma in Nautical Studies on the other hand is completely "sandwiched" from the beginning.

2. The philosophy of training is almost completely ship-oriented.

3. From the early period, the development of MET in Nautical and Marine Engineering are separated through separate departments and probably with very little interaction between them.

4. The sea-service period towards the first CoC is approximately 24 months which could probably be reduced if the shore-based training curricula is rationalised.

5. Both the Deck and Marine Engineering Cadet schemes rely on sponsors from the shipping industry and are therefore beholden to some extend to shipowners' demands.
Singapore was once a British Colony. Inevitably, the MET system which is intricately related to the examination and certification structure of merchant navy officers is based on British traditions.

MET as mentioned in Chapter One are carried out at two institutions— the Singapore Polytechnic for officers and the National Maritime Board mainly for ratings and for lower level officers. The examination and certification regulations are legislated under The Merchant Shipping Act (Chapter 172), The Merchant Shipping (Deck Officer) Regulations 1986 and The Merchant Shipping (Marine Engineer Officer) Regulations 1986.

Certificates of Competency issued under the Regulations are:[1]

**Deck Officers**

Certificate of Competency (Deck Officer) Class 1 (Master Mariner)
Certificate of Competency (Deck Officer) Class 2
Certificate of Competency (Deck Officer) Class 3
Certificate of Competency (Deck Officer) Class 4 (Home-Trade Master)*
Certificate of Competency (Deck Officer) Class 5 and
Certificate of Competency (Deck Officer) Class 6

**Marine Engineers**

Certificate of Competency (Marine Engineer Officer)

Class 1
Certificate of Competency (Marine Engineer Officer)
Class 2
Certificate of Competency (Marine Engineer Officer)
Class 3
Certificate of Competency (Marine Engineer Officer)
Class 4 and
Certificate of Competency (Marine Engineer Officer)
Class 5

(NB: * Home-Trade refers to a restricted trading area the geographical co-ordinates of which are defined in the Regulations.)

In addition, various classes of Certificates of Service for deck and engineer officers are also issued.

2.1 The Training Schemes

For young persons who intend to become merchant navy officers, two channels are open:

1. by direct entry into one of the shipping companies, or
2. by enrolment into one of the formalized training schemes at either the Singapore Polytechnic or the National Maritime Board.

The direct entry scheme for cadets are generally used by shipowners to engage Singaporeans or foreigners who are not eligible for admission into Singapore Polytechnic. Quite recently, due to the shortage of ship officers and the intention to promote Singapore as a total maritime centre, the Marine Department has been promoting the direct entry cadet scheme. The Marine Department has asked the National Maritime Board to conduct short Pre-Sea Induction courses for deck and
engineer cadets. The Marine Department has also asked Singapore Polytechnic to consider running a watchkeeper's course and to accept direct entry cadets in the Correspondence course. In this chapter, the writer shall concentrate only on the present nautical and marine engineering diploma schemes in the Singapore Polytechnic and the watchkeeping engineers training scheme at the National Maritime Board. The direct entry method will not be discussed further.

The majority of new entrants into the merchant navy come from "O"-level (10 years of general-education) school leavers who upon meeting the minimum entry requirements may join either the Diploma in Nautical Studies or the Diploma in Marine Engineering training schemes. Vocational school leavers with appropriate National Trade Certificates (NTC) may opt to join the Watchkeeping Engineers Course offered by the National Maritime Board.

Table 2.1 on the following page shows the minimum requirements for entry into the Singapore Polytechnic, Diploma in Nautical Studies and Diploma in Marine Engineering cadet training schemes.
<table>
<thead>
<tr>
<th>General Certificate of Education (GCE) &quot;O&quot;-Level Subjects</th>
<th>Min GCE &quot;O&quot;-Level Grades</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dip Naut St</td>
</tr>
<tr>
<td>English</td>
<td>1-7</td>
</tr>
<tr>
<td></td>
<td>and</td>
</tr>
<tr>
<td>Mathematics</td>
<td>1-6</td>
</tr>
<tr>
<td></td>
<td>and</td>
</tr>
<tr>
<td>Relevant Third Subjects</td>
<td>one of the following subjects</td>
</tr>
<tr>
<td>Physical Science</td>
<td>1-6</td>
</tr>
<tr>
<td>Science (Physics, Chemistry)</td>
<td></td>
</tr>
<tr>
<td>Science (Physics, Chemistry, Biology)</td>
<td></td>
</tr>
<tr>
<td>Integrated Science</td>
<td></td>
</tr>
<tr>
<td>Combined Science</td>
<td></td>
</tr>
<tr>
<td>Engineering Science</td>
<td>1-6</td>
</tr>
<tr>
<td>Physics</td>
<td>in any other subjects</td>
</tr>
<tr>
<td>Science (Physics, Biology)</td>
<td></td>
</tr>
<tr>
<td>Chemistry</td>
<td>1-6</td>
</tr>
<tr>
<td>Science (Chemistry, Biology)</td>
<td></td>
</tr>
<tr>
<td>Biology</td>
<td></td>
</tr>
<tr>
<td>Electricity and Electronics</td>
<td></td>
</tr>
<tr>
<td>Art</td>
<td></td>
</tr>
</tbody>
</table>

2.1.1 The Diploma in Nautical Studies, Deck Cadet Training scheme

This three-year training programme prepares students for a Diploma in Nautical Studies and for their first professional qualification, the Class 3 Certificate of Competency.

The course is divided into three Phases:

Phase 1, consist of a 20-week induction Pre-Sea Induction Course at the Singapore Polytechnic (SP) that prepare the students for work as cadets aboard ships and emphasises safety procedures and practices. Subjects taught include Mathematics, Physics, Navigation, Chartwork, General Ship Knowledge, Meteorology, Seamanship, Communications and Basic Computing.

Phase 2, consists of at least 24 months of shipboard service in a capacity and in a trade acceptable to Marine Department. In addition, the students are to complete a correspondence course, keep the Deck Cadet Record Book and a Deck Journal.

Phase 3, consists of a preparatory course of study at the SP for the Diploma and Class 3 CoC examinations. Subjects taught include General Ship Knowledge, Navigation, Chartwork, Meteorology, Physics, Mathematics, Seamanship and Communications. During this period, the student also attends a number of short modular courses such as Electronic Navigation Systems, First Aid, Oil, Chemical and Liquefied Gas Tanker Familiarisation and Restricted Radio-telephony which are all pre-requisite to the issue of the Class 3 CoC by the Marine Department.
2.1.2 Progression towards Deck Officer Class 2 and Class 1

The holder of the Class 3 CoC may proceed towards
the Class 2 and Class 1 CoCs by first satisfying sea-service requirements and passing examinations. Preparatory courses of 20 weeks each for these two Classes are also conducted at the SP. (see Figure 2.1)

Figure 2.2 - Ratings to Officers Certification System (Deck Officers)
2.1.3 Additional qualifications

In addition to satisfying the sea-service requirements and passing the examination, a candidate must also have attended and obtained certificates of the short courses as shown in Table 2.2.

Table 2.2- Additional Qualifications[3]

<table>
<thead>
<tr>
<th>Additional Qualifications</th>
<th>Class of Certificate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radar Interpretation and Plotting certificate</td>
<td>1 2 3 4 5 6</td>
</tr>
<tr>
<td>Electronic Navigational Systems certificate</td>
<td>x</td>
</tr>
<tr>
<td>Navigational Control Course attendance certificate</td>
<td>x</td>
</tr>
<tr>
<td>First Aid at Sea certificate</td>
<td>x x x</td>
</tr>
<tr>
<td>Ships' Captain Medical Training certificate</td>
<td>x x</td>
</tr>
<tr>
<td>Fire-Fighting Course attendance certificate</td>
<td>x x x x</td>
</tr>
<tr>
<td>Proficiency in Survival Craft certificate</td>
<td>x x</td>
</tr>
<tr>
<td>Efficient Deck-Hand certificate</td>
<td>x x</td>
</tr>
<tr>
<td>Restricted Radiotelephone Operator's certificate</td>
<td>x x x</td>
</tr>
<tr>
<td>Shipboard Management Course attendance certificate</td>
<td>x x x</td>
</tr>
<tr>
<td>Basic Oil, Chemical and LG Tanker Familiarisation Course attendance cert.</td>
<td>x</td>
</tr>
</tbody>
</table>

2.2 **Diploma in Marine Engineering - Engineer Cadet Training scheme**

This course prepares the student for the Diploma examination and for their six months shipboard cadetship at the end of the three-year full-time study at the Singapore Polytechnic.

**Subjects of study:**

<table>
<thead>
<tr>
<th>First Year</th>
<th>Second Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>English for Academic Purposes</td>
<td>English for Occupational Purposes</td>
</tr>
<tr>
<td>Engineering Mathematics I</td>
<td>Engineering Mathematics II</td>
</tr>
<tr>
<td>Engineering Drawing I</td>
<td>Engineering Drawing II</td>
</tr>
<tr>
<td>Applied Heat I</td>
<td>Applied Heat II</td>
</tr>
<tr>
<td>Applied Mechanics I</td>
<td>Applied Mechanics II</td>
</tr>
<tr>
<td>Electrotechnology I</td>
<td>Electrotechnology II</td>
</tr>
<tr>
<td>Workshop Technology</td>
<td>Instrumentation</td>
</tr>
<tr>
<td>Workshop Practice</td>
<td>Marine Systems I</td>
</tr>
<tr>
<td>Swimming</td>
<td>Marine Power Plant I</td>
</tr>
<tr>
<td></td>
<td>Workshop Practice</td>
</tr>
</tbody>
</table>

Two months of Vacation Training in approved shipyard or workshop.

<table>
<thead>
<tr>
<th>Third Year (Two Terms)</th>
<th>Pre-Sea Prog. (Final Term)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction to Computer Applications</td>
<td>Module 1 Fire-Fighting</td>
</tr>
<tr>
<td>Electrotechnology III</td>
<td>Module 2 Proficiency in Survival Craft</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Marine Automation</th>
<th>Module 3 First Aid at Sea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marine Systems II</td>
<td>Module 4 Tanker Safety</td>
</tr>
<tr>
<td>Marine Power Plant II</td>
<td>Module 5 Management for</td>
</tr>
<tr>
<td>Naval Architecture</td>
<td>Engineers</td>
</tr>
<tr>
<td>Marine Workshop</td>
<td>Module 6 Computer Module</td>
</tr>
<tr>
<td>Simulator</td>
<td>Three</td>
</tr>
<tr>
<td></td>
<td>Module 7 Simulator</td>
</tr>
</tbody>
</table>

### Fourth Year

The students undergo training for six months as cadet engineer on board ships.

#### 2.2.1 Progression towards Marine Engineer Class 2 and Class 1

After the initial period of cadetship, the holder of the Diploma in Marine Engineering may proceed to Class 2 and Class 1 after satisfying sea-service requirements and passing examinations. Preparatory courses of 15-week duration for each of these classes are also conducted at the Singapore Polytechnic. (See Figure 2.3 on page 31).

#### 2.2.2 Watchkeeping Engineers Training Scheme at NMB

As mentioned in paragraph 2.1, school leavers with vocational training and holders of appropriate National Trade Certificates may opt to join the WEC conducted at the NMB. The course is divided into two phases. The first phase comprises 12-month of theoretical and workshop study ashore. The second phase is a 12-month on-the-job training onboard a ship. On completion of the two-year training, the students may sit for the Class 5 examination conducted by the Marine Department.
Progression into the Marine Engineer Class 4 up to Class 1 is then possible via qualifying sea-service and examinations (see Figure 2.3 on the next page).

Other schemes in which a person may become a Marine Engineer Officer, e.g. starting as ratings are available. Details of such schemes can be found in The Merchant Shipping Regulations and will not be described here.
Figure 2.3 - MET and Certification System (Marine Engineers)

CoC (Mar Eng) Class 1

18 months sea-service

CoC (Mar Eng) Class 2

18 months sea-service

Diploma in Marine Eng + Class 5

6 months sea-service

3 year shore-based at SP

GCE "O"-Level

CoC (Mar Eng) Class 3

9 months sea-service

CoC (Mar Eng) Class 4

12 months sea-service

CoC (Mar Eng) Class 5

12 months sea-service

12 months shore-based studies at NMB

National Trade Cert.

Ratings

60 to 66 months sea-service
2.2.3 Additional qualifications

Additional qualifications needed prior to the issue of each class of COC is shown in Table 2.3.

**Table 2.3—Additional Qualifications[5]**

<table>
<thead>
<tr>
<th>Additional Qualifications</th>
<th>Class of Certificates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Fire-Fighting Course attendance certificate</td>
<td>X</td>
</tr>
<tr>
<td>First Aid at Sea certificate</td>
<td>X</td>
</tr>
<tr>
<td>Proficiency in Survival Craft certificate</td>
<td>X</td>
</tr>
<tr>
<td>Shipboard Management Course attendance certificate</td>
<td>X</td>
</tr>
<tr>
<td>Shipboard Management for Marine Engineers Course</td>
<td></td>
</tr>
</tbody>
</table>

CHAPTER THREE

OVERVIEW OF THE SINGAPORE SHIPPING INDUSTRY AND THE ANALYSIS OF MANPOWER NEEDS AND SUPPLY

The primary function of MET is to provide shipboard personnel for national ships. However, the old concept that MET must be solely sea-oriented is losing ground especially in traditionally developed maritime nations. "MET in countries with a well-developed maritime and educational infrastructure and high labour costs has become Janus-faced by serving both ship and shore. The attitude to seafaring has undergone changes. It has helped to develop an increased shore-orientation of MET. The attraction of the sea as a career has been affected too; it has been diminished ...."[1]. Is Singapore MET on the brink of a similar situation?

Education and Training (ET) is about the future and especially so in MET where there is a long lead time from entry to Master or Chief Engineer. Demands and needs of the future are always very difficult to forecast in the shipping industry. For this reason, scientific manpower forecasting for shipboard personnel is seldom carried out even in countries with well-developed maritime traditions. Extrapolations into the maritime industry is fraught with even more difficulties of so many unknown parameters. Nevertheless, some forecast of demand is needed. So

where do we begin?

Statistical records of the Singapore fleet can provide some underlying trends and hopefully a reasonable demand prediction. Hopefully, statistics of "O"-level school leavers would provide a reasonable prediction of supply.

3.1 Analysis of Manpower Needs

3.1.1 The Singapore Registry: growth and trend

Registration of ships has been a function of the Marine Department since colonial days when it exercised the function of a Registrar of British Ships. After independence, the Singapore Registry of Ships was established by the Merchant Shipping (Amendment) Act 1966 which came into force on 2 September 1966.

The Singapore Registry grew from 25 ships (GRT 41,592) in 1967 to 1,031 ships (GRT 7,869,152) by 1979. The spectacular growth of the registry can be attributed to two factors: the growth in sea-borne trade and the implementation of the "Open-Registry" on 31 Jan 1969.

In 1979, another review was made of the Singapore Registry and more stringent requirements for the registration of ships were introduced. The "Open-Registry" system was eventually abandoned with the promulgation of the Merchant Shipping (Registration of Ships) Regulations in 1981. After 1979, there was a gradual decline in the number reaching 700 ships (GRT 7,098,116) in 1987. On 1 January 1989, the number stood at 712 (GRT 7,272,506). From 1979 to 1983 also
saw the decline in world sea-borne trade from 3,714 million to 3,090 million tonnes.

Table 3.1 shows the growth of the Singapore Registry since 1967 and Figures 3.1 and 3.2 describe it graphically. Figure 3.3 shows graphically the increase in seaborne trade and its correlation with the growth of the Singapore Registry.

Table 3.1—Growth of Singapore Registry[2]

<table>
<thead>
<tr>
<th>Year</th>
<th>Ships</th>
<th>GRT</th>
<th>Average GRT/Ship</th>
</tr>
</thead>
<tbody>
<tr>
<td>1967</td>
<td>25</td>
<td>41,590</td>
<td>1,664</td>
</tr>
<tr>
<td>1968</td>
<td>73</td>
<td>133,855</td>
<td>1,834</td>
</tr>
<tr>
<td>1969</td>
<td>112</td>
<td>233,271</td>
<td>2,083</td>
</tr>
<tr>
<td>1970</td>
<td>153</td>
<td>424,417</td>
<td>2,774</td>
</tr>
<tr>
<td>1971</td>
<td>185</td>
<td>581,777</td>
<td>3,145</td>
</tr>
<tr>
<td>1972</td>
<td>281</td>
<td>870,513</td>
<td>3,098</td>
</tr>
<tr>
<td>1973</td>
<td>387</td>
<td>2,004,269</td>
<td>5,179</td>
</tr>
<tr>
<td>1974</td>
<td>511</td>
<td>2,878,327</td>
<td>5,632</td>
</tr>
<tr>
<td>1975</td>
<td>610</td>
<td>3,891,902</td>
<td>6,380</td>
</tr>
<tr>
<td>1976</td>
<td>722</td>
<td>5,481,720</td>
<td>7,592</td>
</tr>
<tr>
<td>1977</td>
<td>872</td>
<td>6,791,398</td>
<td>7,788</td>
</tr>
<tr>
<td>1978</td>
<td>954</td>
<td>7,489,205</td>
<td>7,850</td>
</tr>
<tr>
<td>1979</td>
<td>1,031</td>
<td>7,869,152</td>
<td>7,633</td>
</tr>
<tr>
<td>1980</td>
<td>988</td>
<td>7,664,229</td>
<td>7,757</td>
</tr>
<tr>
<td>1981</td>
<td>828</td>
<td>6,888,452</td>
<td>8,139</td>
</tr>
<tr>
<td>1982</td>
<td>849</td>
<td>7,183,326</td>
<td>8,461</td>
</tr>
<tr>
<td>1983</td>
<td>855</td>
<td>7,009,106</td>
<td>8,198</td>
</tr>
<tr>
<td>1984</td>
<td>825</td>
<td>6,512,344</td>
<td>7,894</td>
</tr>
<tr>
<td>1985</td>
<td>758</td>
<td>6,504,582</td>
<td>8,581</td>
</tr>
<tr>
<td>1986</td>
<td>716</td>
<td>6,267,627</td>
<td>8,754</td>
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<tr>
<td>1987</td>
<td>700</td>
<td>7,098,116</td>
<td>10,140</td>
</tr>
<tr>
<td>1988</td>
<td>715</td>
<td>7,208,974</td>
<td>10,082</td>
</tr>
<tr>
<td>1989</td>
<td>712</td>
<td>7,272,506</td>
<td>10,214</td>
</tr>
</tbody>
</table>

Figure 3.1 - Growth of Singapore Fleet 1967-1979[3]

Figure 3.2 - Growth of Singapore Fleet 1980-1989[4]

Figure 3.3 - Trend in World Seaborne-Trade 1975-1988[5]

3.1.2 Classification of ships by age

One of the evolutionary approaches to MET is integrated training in one form or another. Proponents of this concept argued that changes in vessel design, technology and equipment provide opportunity for changes in shipboard organisation with cost saving through crew reduction as the overriding factor. Others spoke of a high level of training and education to match the skills required onboard new, sophisticated and technologically advanced ships.

If MET is to continue to be viable into the future, it must also be sensitive to the development of the national fleet it is serving. Analysis of appropriate needs of MET in meeting the requirements of ships of the immediate and medium future require extensive research and fair amount of subjective judgements that consensus are more often widely divided. However, it appears from the statistics that demand for MET in Singapore will continue to grow into the future.

The writer suggest that analysis of the national registry by age groups may provide predictions in trends provided the assumptions made are accepted as being reasonable. Table 3.2 and Fig 3.4 give a breakdown of Singapore vessels into six age groups. The median age of Singapore fleet is 12 years and more than 57% of the ships are above 12 years.
<table>
<thead>
<tr>
<th>Ship types</th>
<th>0-4</th>
<th>5-9</th>
<th>10-14</th>
<th>15-19</th>
<th>20-24</th>
<th>25+</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>O. Tanker</td>
<td>21</td>
<td>17</td>
<td>30</td>
<td>49</td>
<td>24</td>
<td>10</td>
<td>151</td>
</tr>
<tr>
<td>Chem Tnkr</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>L&amp;G</td>
<td>-</td>
<td>7</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>21</td>
</tr>
<tr>
<td>OBO</td>
<td>3</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>4</td>
</tr>
<tr>
<td>Bulk/Ore</td>
<td>7</td>
<td>36</td>
<td>23</td>
<td>6</td>
<td>1</td>
<td>-</td>
<td>73</td>
</tr>
<tr>
<td>Container</td>
<td>3</td>
<td>8</td>
<td>25</td>
<td>10</td>
<td>1</td>
<td>1</td>
<td>48</td>
</tr>
<tr>
<td>Gen. Cargo</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single Deck</td>
<td>2</td>
<td>10</td>
<td>17</td>
<td>18</td>
<td>11</td>
<td>3</td>
<td>61</td>
</tr>
<tr>
<td>Multi Deck</td>
<td>2</td>
<td>13</td>
<td>27</td>
<td>32</td>
<td>23</td>
<td>6</td>
<td>103</td>
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<tr>
<td>Passenger</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ferries</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
</tbody>
</table>

**Total** 40 94 129 120 64 23 470

---

Figure 3.4 - Distribution of Singapore Fleet by Age Group (1 Jan '89)[7]

Assumptions:

1. All ships in age group 0–4 years are sophisticated enough for being easily upgraded for reduced manning. This represents 40 ships or 8.5% of the total fleet under consideration.

2. That all ships presently above 20 years (87 ships) will be scrapped or sold within the next 10 years and replaced. 80% of the replacements are second-hand ships and 20% (18 ships) are sophisticated new buildings suitable for reduced manning. This will bring the number to about 58 ships or 12% of the fleet (assuming the Singapore Registry remains at present level).

The writer feels that the assumptions are very conservative and on the low side. Many of the newer ships are concentrated and distributed among only few shipping companies. For example, Singapore National Shipping Line, Neptune Orient Line (NOL) claim that 50% of their 48 ships are sophisticated enough for reduced manning[8]. They have about five new buildings under construction.

3.1.3 Shipowners/managers/agencies: Employment opportunities for shipboard personnel.

A look at the shipping companies and agencies will provide some idea on the users of MET graduates and of those that are and will likely to be supportive of MET. Lloyd’s Maritime Directory lists 98 shipping companies, managers and agencies operating in Singapore. Records from the SP, Departments of Nautical and Marine

Engineering has shown that the companies listed below have played active roles in supporting MET and sponsoring trainees.

1. Neptune Orient Lines 48 ships
2. AP Moeller (Maersk Lines) 20 ships (estimate)
3. Thome and Co. Pte Ltd 6 ships
4. Oriental Shipmanagement 6 ships
5. Pacific Carriers Pte Ltd 8 ships

Total 88 ships

The other companies who adopt a laissez-faire attitude to MET are however often "pinchers" of MET graduates who were probably sponsored by one of the five companies listed above. Therefore these companies are also significant employers of MET graduates.

As of 1 January 1989, there are 550 Singapore registered ships having valid crew agreements. These ships employed a total of 10,618 seafarers on board. Of these, 4,949 were officers and 5,669 ratings. About 20% each, of the officers and ratings were Singaporeans."[9]

3.1.4 Future growth of Singapore Registry

The Singapore Registry has shown signs of positive growth. It reached eight million GRT for the first time in mid-December 1989. The growth can be contributed to two factors:

1. the optimistic global outlook of seaborne-trade, and

2. the effective policy of the government in promoting Singapore as a total maritime centre.

On August 1989, the Director of Marine said "...the Marine Department job was to develop Singapore shipowning base. Since the potential for local growth is limited, there is a need to encourage foreign owners and shipmanagers to set up in Singapore."[10] An encouraging press release was made in October 1989 by Member of Parliament, Dr Hong Hai as Chairman of the Government Parliamentary Committee for Communications and Information: "In order to build a critical mass for a strong shipping industry, it is necessary to attract more foreign shipowners and managers to operate from Singapore."[11]

On 1 November 1989, officials from the shipping industry and government embarked on a three-day mission to woo Hongkong shipowners. Similar mission to Japan, USA and Europe are planned for 1990. If the mission to Hongkong is successful in attracting shipowners to re-register their ships under the Singapore flag, the Singapore Registry may double to 16 million GRT.

3.1.5 Analysis of demand

There is definitely a need for more Singaporean ship officers and the information provided by the Director of Marine substantiates this conclusion. However, a large portion of the shipping companies are either foreign owned or are shipmanagement companies. How committed are they to the long term manpower

planning for the industry is a question to which it is difficult to get a clear answer.

However, if one goes by the present figures and makes an assumption that the Singapore fleet shall remain level at, say, 500 ships for the next decade and longer, then we may at least have a basis from which to do the calculations. If on average each ship would need seven officers and be backed up by an equal number to cover leave, study, training, sickness etc. then the number of officers required would be 7,000. Assuming that the attrition rate is about 10% overall, gives an actual intake of about 700 annually. If the assumptions made is accepted as being reasonable, then this number represents the probable rate of flow through the MET system to achieve some form of stability in the total shipboard manpower supply/demand situation.

If we consider the 0-4 years age group of ships as being suitable for reduced manning; presuming of course that these ships are sufficiently sophisticated, then some idea on the future demand for integrated officers can be formed. The figures show that the number of ships of this category represents 8.5% of the fleet and will possibly rise to 12% by the next decade. A majority of the ships in the next decade or longer will still require the present level of manning of monovalent officers. NOL however claims that 50% of their ships are suitable for reduced manning and being the major sponsors of MET their future manning policy will exert influence on MET. "Since NOL is the leading employer in this field and is the only company that built ships with the latest technology, definitely we will play an active role in any reduced manning
Demand for qualified manpower by the maritime industry ashore is another area that should be considered. Whether in restructuring the present MET system would allow incorporation of such needs into the mainstream curriculum for ET of shipboard personnel or preferably for it to remain outside such curriculum will require extensive discussion among the various parties. What the writer wants to emphasise here is that there are opportunities to provide a ship-shore mobility in the MET curriculum. The demand is certainly there though sometimes it is obscured through lack of "marketing" the "products" of MET. Lua Cheng Eng, President of the Singapore National Shipping Association was optimistic that Singapore "may attract some major Hongkong shipowners and operators......" and noting that such influx will put "increased pressure for qualified shore and sea-based personnel".

3.2 Analysis of Manpower Supply

Demand for MET is essential to its development. Equally important is the availability of quality entrants which represent the supply side. In the Singapore context, prospective new entrants come mainly from the General Certificate of Education (GCE) "O"-level school leavers. In general, a young person in Singapore will have six years of primary and four years of secondary education by the time he leaves school with a GCE "O"-level.


GCE "O"-level school leavers who wish to continue their studies have a number of options to choose from. These options may be considered as MET competitors in term of winning academically good students. The following institutions compete for GCE "O"-level school leavers:

1. The Polytechnics:
   a) Singapore Polytechnic (courses other than MET)
   b) Ngee Ann Polytechnic
   c) Temasek Polytechnic (a new polytechnic from June 1990)

2. Post Secondary Education (other than tertiary institutions) Centres:
   a) Pre-University Centres (24 centres)
   b) Centralised Institute of Education (two centres)
   c) Junior Colleges (14 centres)

From the year 1977 to 1988 saw an increased of Post Secondary Education centres from 32 to 40 centres. This represent an increase in first year enrolment places from 8,812 to 14,534, an increase of 64.9%.

In 1982, the Ngee Ann Polytechnic which was a college until then, became a full polytechnic. Both Singapore and Ngee Ann Polytechnics were embarking on expansion programmes.
Table 3.3 shows the combined first year enrolment of the two polytechnics from 1978 to 1988 increased from 3,317 to 8,912, an increase of 168.7%. The total increase in first year enrolment places for the same period was from 12,136 to 26,290, an increase of 116.6% while the number of GCE school leavers from 1977 to 1987 increased from 22,174 to 32,733, an increase of only 47.6%. Fig 3.5 represent this graphically.
### Table 3.3 (thousands) of GCE "O"-Level School Leavers & their Distributions to Higher Institutes of Learning [14]

<table>
<thead>
<tr>
<th>Years</th>
<th>77</th>
<th>78</th>
<th>79</th>
<th>80</th>
<th>81</th>
<th>82</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. GCE School Leaver</td>
<td>22174</td>
<td>22428</td>
<td>23894</td>
<td>22360</td>
<td>23361</td>
<td>25067</td>
</tr>
<tr>
<td>2. Pre-University 1st year</td>
<td>2911</td>
<td>2711</td>
<td>2210</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Central Inst. 1st year</td>
<td>8288</td>
<td>7423</td>
<td>5669</td>
<td>5223</td>
<td>5709</td>
<td></td>
</tr>
<tr>
<td>4. Junior Colleges 1st year</td>
<td>531</td>
<td>498</td>
<td>581</td>
<td>460</td>
<td>543</td>
<td></td>
</tr>
<tr>
<td>5. Private Inst. 1st year</td>
<td>8819</td>
<td>7921</td>
<td>9161</td>
<td>8494</td>
<td>8462</td>
<td></td>
</tr>
<tr>
<td>6. S'pore Poly 1st year</td>
<td>2585</td>
<td>2527</td>
<td>2480</td>
<td>3742</td>
<td>4194</td>
<td></td>
</tr>
<tr>
<td>7. Ngee Ann Poly 1st year</td>
<td>732</td>
<td>812</td>
<td>1112</td>
<td>1154</td>
<td>1734</td>
<td></td>
</tr>
<tr>
<td><strong>Sub-total</strong></td>
<td>3317</td>
<td>3339</td>
<td>4592</td>
<td>4896</td>
<td>5928</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>12135</td>
<td>11250</td>
<td>13753</td>
<td>13390</td>
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</table>

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<table>
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<th>85</th>
<th>86</th>
<th>87</th>
<th>88</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. GCE School Leavers</td>
<td>28869</td>
<td>27371</td>
<td>25933</td>
<td>33083</td>
<td>32733</td>
<td></td>
</tr>
<tr>
<td>2. Pre-University 1st year</td>
<td>2788</td>
<td>2465</td>
<td>2467</td>
<td>2474</td>
<td>2277</td>
<td>2156</td>
</tr>
<tr>
<td>3. Central Inst. 1st year</td>
<td>6988</td>
<td>688</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Junior Colleges 1st year</td>
<td>7310</td>
<td>7801</td>
<td>9828</td>
<td>11080</td>
<td>11884</td>
<td>13941</td>
</tr>
<tr>
<td>5. Private Inst. 1st year</td>
<td>649</td>
<td>688</td>
<td>859</td>
<td>756</td>
<td>700</td>
<td>593</td>
</tr>
<tr>
<td><strong>Sub-total</strong></td>
<td>9947</td>
<td>10954</td>
<td>13154</td>
<td>14310</td>
<td>15270</td>
<td>17378</td>
</tr>
<tr>
<td>6. S'pore Poly 1st year</td>
<td>4697</td>
<td>5298</td>
<td>4820</td>
<td>4465</td>
<td>5162</td>
<td>4887</td>
</tr>
<tr>
<td>7. Ngee Ann Poly 1st year</td>
<td>2252</td>
<td>3482</td>
<td>3912</td>
<td>3793</td>
<td>4149</td>
<td>4025</td>
</tr>
<tr>
<td><strong>Sub-total</strong></td>
<td>6949</td>
<td>8780</td>
<td>8732</td>
<td>8198</td>
<td>9311</td>
<td>8912</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>16896</td>
<td>19734</td>
<td>21886</td>
<td>22568</td>
<td>24581</td>
<td>26290</td>
</tr>
</tbody>
</table>

---

[14] 1,2,3,4 & 5 Education Statistics 1988, p.23,31,34  
6,7, Yearbook of Statistics 1988, p.302,303
### Table 3.4 - Singapore Polytechnic Total First Year vs NET Courses Enrolment [15]

<table>
<thead>
<tr>
<th>Year</th>
<th>78</th>
<th>79</th>
<th>80</th>
<th>81</th>
<th>82</th>
<th>83</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Total 1st Year Enrolment:</td>
<td>2585</td>
<td>2527</td>
<td>3400</td>
<td>3742</td>
<td>4194</td>
<td>4697</td>
</tr>
<tr>
<td>% Increase Over 1978:</td>
<td>100%</td>
<td>98.4%</td>
<td>134.6%</td>
<td>144.8%</td>
<td>162.2%</td>
<td>181.7%</td>
</tr>
<tr>
<td>2. Dept of Naut Studies:</td>
<td>94</td>
<td>107</td>
<td>107</td>
<td>94</td>
<td>88</td>
<td>66</td>
</tr>
<tr>
<td>3. Dept of Marine Eng:</td>
<td>130</td>
<td>119</td>
<td>88</td>
<td>74</td>
<td>74</td>
<td>177</td>
</tr>
<tr>
<td>Total NET Enrolment:</td>
<td>224</td>
<td>226</td>
<td>195</td>
<td>158</td>
<td>162</td>
<td>243</td>
</tr>
<tr>
<td>% Change Over 1978:</td>
<td>100%</td>
<td>100.9%</td>
<td>87.1%</td>
<td>70.5%</td>
<td>72.3%</td>
<td>108.5%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
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<th>85</th>
<th>86</th>
<th>87</th>
<th>88</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Total 1st Year Enrolment:</td>
<td>5298</td>
<td>4820</td>
<td>4405</td>
<td>5162</td>
<td>4887</td>
</tr>
<tr>
<td>% Increase Over 1978:</td>
<td>205%</td>
<td>186.5%</td>
<td>170.4%</td>
<td>199.7%</td>
<td>189.1%</td>
</tr>
<tr>
<td>2. Dept of Naut Studies:</td>
<td>54</td>
<td>71</td>
<td>71</td>
<td>83</td>
<td>96</td>
</tr>
<tr>
<td>3. Dept of Marine Eng:</td>
<td>180</td>
<td>127</td>
<td>47</td>
<td>70</td>
<td>93</td>
</tr>
<tr>
<td>Total NET Enrolment:</td>
<td>234</td>
<td>198</td>
<td>118</td>
<td>153</td>
<td>189</td>
</tr>
<tr>
<td>% Change Over 1978:</td>
<td>104.5%</td>
<td>88.4%</td>
<td>52.7%</td>
<td>68.3%</td>
<td>84.4%</td>
</tr>
</tbody>
</table>

2 & 3, Singapore Polytechnic Annual Reports
Fig 3.5 - GCE "O"-Level School Leavers and Distribution to Higher Institutions[16]

Table 3.4 and Fig 3.6 analyses the first year enrolment of MET courses against the total first year enrolment of the Singapore Polytechnic. This shows that while the total enrolment had increased by 89.1% from 1978 to 1988, the enrolment for MET courses had fallen by 15.6%. Figure 3.6 shows the situation very clearly.
Fig 3.6 - Comparison of Singapore Polytechnic Total Enrolment and MET Courses Enrolment[17]

3.2.2 Analysis of supply

Table 3.3 and Figure 3.5 show that the rate of increase in the number of first year enrolment places in the various institutions for GCE "O"-level school leavers is greater than the rate of increase in the number of GCE "O"-level school leavers. It can be concluded that there is a dilution in the number of quality students arising from the increase in spread. Since all courses and institutions are vying for the best students, the quality students are skewed towards the more popular courses. Unpopular courses have to content with the students of lesser ability and shrinking numbers. Table 3.4 and Figure 3.6 show that over the period from 1978 to 1988, the enrolment for MET courses can be described as erratic and that the general trend showed a gradual decline despite the increased in the total enrolment of the Singapore Polytechnic. Unless this situation is addressed quickly, MET will face a serious shortage in the supply of good students in the future.

Those associated with MET and in particular shipowners and education and training institutions must be concerned with addressing this issue. Shipowners need to consider making seafaring a more rewarding career by providing better conditions of service, security of employment and professional mobility from ship to shore. The maritime institutions must ensure that their curriculum while satisfying the needs of the industry must also consider the aspirations of the students and society in general. The archaic philosophy of training for the ships only will have to go.
CHAPTER FOUR

PRESSURES FOR CHANGE IN THE MET SYSTEM

It is clear from the previous chapters that Singapore had depended heavily on the United Kingdom as a source after which her MET had been modelled. The system centred around preparatory courses for the Marine Department Certificate of Competency examinations and demarcated along traditional job functions, viz, Deck, Engine and Radio departments. The main concern of the Administration are safety and environment.

Another feature of the system are sponsorships by shipping companies who therefore have a strong influence in the MET system which they exercised through their representations in the Shipping Advisory Committee of the Singapore Polytechnic, the National Maritime Board and organizations such as the Singapore Maritime Employers Federation (SMEF). For many years most if not all, had favoured the philosophy of training for the sea only. The existing MET system which does not cater to the long term social and career needs of the students was appropriate for as long as there are sufficient qualified school-leavers who are willing to go to sea.

The aim of this chapter is to identify the main pressures in the MET system and their sources. They can be divided in two parts, namely those that are unique only to the domestic situation and those that affect shipping and MET in general.
4.1 Domestic Pressures on the MET System and Their Sources

4.1.1 The need to make MET attractive to Singapore’s school leavers.

In Chapter 3, it was shown that applicants into the MET courses can be described as erratic and that the general trend showed a gradual decline over the years and it is apparent from the statistical data that MET courses are the least popular in comparison to other courses offered at the tertiary level. It is very important to understand the underlying factors that may have contributed to its unpopularity.

1. Demographic trends and their impact on the future supply of MET cohorts.

In the later part of the sixties, in an effort to curb the rate of population growth the government was actively promoting the two-child family — “Two is Enough” campaign. This policy was very successful and Figure 4.1 show the annual rate of population growth decrease quite rapidly since 1964.
The demographic trend has some effect on the number of young people joining the industries and coupled with the rapid economic growth and period of industrialisation has contributed to the shortage of labour supply. The shipping industry must compete for school-leavers with the other industries. Due to the nature of seafaring and the existing MET which are perceived as inferior to other education, the shipping industry is having difficulties in attracting good young men. It is fair to assume that if most Singaporean are only having two children then the likely make-up will be one son and one daughter. Traditionally only males go to sea and parents with one

son are understandably very reluctant to allow him to go to sea.

2. Social status and professional acceptability

In the Singapore society where the "paper-chased" syndrome is well entrenched, a majority of parents would prefer their children to pursue an education and career which they perceived as being more rewarding and socially "up-the-ladder".

Family pressure and opportunities in shore-based jobs make seafaring less attractive. During the world recession of 1985 when many industries had to retrench workers the Singapore Maritime Officers Union had taken up the issue of unemployment through the newspapers and advocated the closure of MET and issued statements that many officers had to drive taxis for a living. Such emotionally charged statements and other reports of adverse experiences of officers who had left the sea, are quickly circulated and are likely to linger in people's minds, thus further reducing the attractiveness of a seafaring career. Although the shipping industry is not the only one that had to retrench workers, nobody advocated the closure of training in electronics, computer, building, business or other disciplines nor do we read in the newspapers that graduates from other disciplines had to resort to driving taxis!

As mentioned earlier, the philosophy of the existing MET is to train for the sea only. This presupposes that once a person chose a career at sea he will remain there for life. In reality, this is seldom true and studies have shown that on average a seafarer will remain at sea for eight years before leaving seafaring and finding work ashore. Such studies are
well documented, one of them by J.M.M Hill.[2] A potential recruit into seafaring will want to know what his career prospects are. He will be turned off if he feels that he will be "trapped" in a career which is only good at sea and lacking in professional recognition ashore.

3. The erosion of monetary and touristic rewards as incentives for sea-career.

In the past, the wages differential between shore and sea were sufficiently high to attract new recruits to go to sea. Over the last ten years the gap has been greatly narrowed as shown by Table 4.1.

Table 4.1 -Comparison in Rise of Wages[3]

<table>
<thead>
<tr>
<th></th>
<th>1978</th>
<th>1988</th>
<th>% change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average monthly earnings, ashore (Professional, managerial, &amp; executive)</td>
<td>1,370</td>
<td>2,421</td>
<td>+ 76.7</td>
</tr>
<tr>
<td>Wages of a Second Officer aboard FG Ships</td>
<td>2,000</td>
<td>2,200</td>
<td>+ 10</td>
</tr>
</tbody>
</table>

This phenomena were also experienced in Western Europe that lead to reduction of attraction of sea-going careers. Haralambides, "...the affluent society provides better economic conditions and the wages


differential between shore based and equivalent seagoing jobs was either considerably reduced or suppressed."[4]

Similarly, nobody goes to sea anymore to have access to contacts with foreign countries and different cultures. Cost of travel are today within the reach of most Singaporean. The sea-career have therefore, also lost its touristic incentive.

There are therefore two fundamental issues that have to be addressed:

1. how can life at sea be made more interesting, rewarding and challenging? and
2. how can MET itself be improved so as to increase its status, provide opportunities for higher education and provide a foundation for a broader career scope mainly in the maritime industry ashore?

Much of what has been written had also been addressed by others.

"This means that, not only must the work and career be attractive, but also the training and qualification. Few will seek to enter the training programme if it is felt that there will not be significant growth in their knowledge and skills, or if the qualification issued at the end of the training appears to have low status or does not provide

opportunity for higher education." [5]

"He(school-leaver) will want to feel that, if he chooses seafaring, he is not going to be "trapped" in a career which not only has a degree of social unacceptability associated with it, but is also lacking in professional recognition.

Unfortunately the present system of recruitment, employment, certification, education and training is leading in that direction."[6]

"Shipowners must therefore be prepared ........to formulate a long term career development and training policy of seafarers for their requirement. ....If we can assure seafarers of reasonable prospect in their career, then we can attract them to this profession." [7]

Perhaps more than anyone else, Professor Gunther Zade had written much on the subject. His seminar papers, "Education and Training for the Maritime Industry in the Nineties" delivered at the Symposium "Maritime Industry in the Nineties - a European View" (Hogere Zeevaartschool Amsterdam, Netherlands, 24 Oct 1985), "Shipboard Manning and Appropriate Maritime


Education and Training in the 1990’s" delivered at the seminar on "Shipboard Organisation in, and Appropriate Education and Training for, the 1990’s" (Singapore Polytechnic, 17 April 1986) and "The Training of Merchant Marine Officers - what challenges have been and have to be met?" delivered at Conference "1993, an Opportunity for the French Merchant Navy Officer" (Ecole Nationale de la Marine Marchande, Le Havre, France, 16-17 February 1989) underscored the need for changes in the philosophy behind many MET system and emphasises the bivalency and/or ship-shore mobility aspects of MET.

4.1.2 The need to justify the cost of MET vis-a-vis the other disciplines in the Singapore Polytechnic.

G. Zade wrote, "Maritime academies which have become departments of polytechnics or universities and have lost part of their identity can, on the other hand, profit from the access to teaching staff of other departments. Nevertheless, they have to fear that continued or additional austerity measures would expose them to the risk of being considered for closing by revealing their lack of cost effectiveness compared with other departments with a more economic staff-student ratio and less expensive equipment."[8] This statement describes aptly the pressure faced by the two maritime departments of the Singapore Polytechnic since 1986 in justifying their cost of training due to austerity measures arising from the 1985 recession.

[8] G.Zade, "The Training of Merchant Marine Officers-what challenges have been and have to be met?", seminar papers delivered at Conference "1993, an opportunity for the French Merchant Navy Officer", in Le Havre, France at Ecole Nationale de la Marine Marchande, 16-17 February 1989, para 2.3, lines 23-29.
Table 4.2 below show the cost of training for each of the maritime courses offered at the Singapore Polytechnic converted to Full-Time Equivalent (FTE) and based on a staff-student ratio of 1:15.

**Figure 4.2 - Training Cost**

(Revised 5 Jan 1989)

<table>
<thead>
<tr>
<th>Department</th>
<th>No. of Students</th>
<th>Cost of Training</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Actual FTE</td>
<td>Per student per Course</td>
</tr>
<tr>
<td>Dip Marine Eng</td>
<td>255 255</td>
<td>7,638</td>
</tr>
<tr>
<td>Cl 1 Pt B</td>
<td>30 16</td>
<td>8,858</td>
</tr>
<tr>
<td>Cl 2 Pt B</td>
<td>46 24</td>
<td>3,797</td>
</tr>
<tr>
<td>Cl 1 Pt A</td>
<td>10 1</td>
<td>7,134</td>
</tr>
<tr>
<td>Cl 2 Pt A</td>
<td>20 8</td>
<td>1,822</td>
</tr>
<tr>
<td>Naut. Studies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corr Course</td>
<td>460 129</td>
<td>771</td>
</tr>
<tr>
<td>Pre-Sea</td>
<td>83 65</td>
<td>6,404</td>
</tr>
<tr>
<td>Master FG</td>
<td>21 13</td>
<td>5,603</td>
</tr>
<tr>
<td>1st Mate FG</td>
<td>46 29</td>
<td>5,069</td>
</tr>
<tr>
<td>2nd Mate FG</td>
<td>47 33</td>
<td>5,464</td>
</tr>
<tr>
<td>Master HT</td>
<td>6 3</td>
<td>13,443</td>
</tr>
<tr>
<td>Mate HT</td>
<td>10 4</td>
<td>8,707</td>
</tr>
<tr>
<td>Tanker Courses</td>
<td>32 2</td>
<td>399</td>
</tr>
<tr>
<td>Eltrn Nav System</td>
<td>43 5</td>
<td>2,223</td>
</tr>
<tr>
<td>Nav. Control</td>
<td>54 3</td>
<td>943</td>
</tr>
<tr>
<td>Radar Int.&amp; Pltg.</td>
<td>65 2</td>
<td>588</td>
</tr>
<tr>
<td>Radiotelephony</td>
<td>22 1</td>
<td>927</td>
</tr>
<tr>
<td>Shipboard Mngmnt</td>
<td>147 11</td>
<td>395</td>
</tr>
</tbody>
</table>

The cost of providing technological education to

students of a polytechnic as a whole is estimated at S$6,310 of which S$5,470 is subsidised by the Ministry of Education and the remainder borne by the students. All the courses other than maritime courses have had no problem in filling their classes and the actual intake and its full-time equivalent (FTE) is nearly the same. Thus the Cost of Training Per FTE Per Courses for the other courses may be said to be about S$6,310.

It is immediately apparent from Table 4.2 that many of the maritime courses Cost of Training (FTE) well exceed the polytechnic's average. Both the maritime departments may not agree with the blanket mode of calculating training cost which do not take into account specific particularities of the different courses. While some disciplines may have a large period of lectures which are conducive for learning in a large class in a lecture hall environment, maritime courses such as radar, tanker, chartwork, simulator and many of the equipment oriented subjects are only conducive if the class size is small. Many of the maritime courses especially in the nautical studies are short modular courses and do not extend for over the full academic year. The fact that maritime courses have the responsibility of educating and training their graduates not only in academic competency but also professional competency by the time they graduate is an argument not readily accepted by others.

The maritime departments have a difficult task in reducing cost. The paradox is that MET has to produce increasingly highly competent graduates brought about by more stringent international regulations and the rate of increase in shipboard technology.

In the Nautical Studies Department for example there is a realisation that the "sandwiched" system of
MET and the proliferation of short modular courses is expensive and also disruptive for the students. These factors need to be taken into account in designing future MET system.

4.2 General Pressures and its Sources on the MET System

This section identifies the changes that have been taking place in the shipping industry in general and how these changes created new demands on MET.

4.2.1 Technology and automation

World shipping is now emerging from its longest recession in recent history. Its effect on the traditional maritime nations is well documented.

E.G. Frankel, "Shipping has undergone technological, structural and operational change."[10]

D.M. Waters, "The trend to reduction of crew members, spearheaded by the Scandinavian and Japanese operators, has been effected in two main ways:

- Increased automation; and
- Rationalisation of crew organisation and operational practices."[11]

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In the context of Singapore, the national fleet is beginning to learn to manage and to harness these technological changes to assure future competitiveness in a rapidly changing shipping markets.

Toh Ho Tay, "... NOL is the leading employer in this field ....that build ships with the latest technology....".[12]

The pressure that bear on MET as a consequence of the above development is described in section 4.3.

4.2.2 Economics

There is still good profit to be made from shipping. However, the intense competition brought about by recession in international shipping has put further pressure on the margin between profit and loss. Past steps taken to improve competitiveness mainly with the reduction of operating cost through accelerated used of high technology, automation and ship design and, which in turn made it possible to reduce crew size will remain with the industry. The momentum will continue and even pick-up even when high profits return into the industry.

The British Classification Society, Lloyd's Register of Shipping has issued an important new notation (LNC [AA]),[13] specifying standards for the navigational equipment, controls and safeguards required for a ship to operate with a single watchkeeper.


As crew shrink to the very low level possible, the skill matrix of the crew will change by necessity. If we believe in the adage that 'an efficient ship is a profitable ship', then we may see something in competent, highly trained crew and its relationship to education and training.

Economics will also influence the way ships are operated and managed. Greater ship/shore interface and communication will result in improvement of ship productivity translated into faster port turnaround. "Load centering, which was initially touted only as a concept of value to large containership operations, is quietly being introduced in the shipping of major bulk commodities..."[14]

The trend in transferring many management functions aboard ships and treating them as cost-centres will probably increase as the emphasis will change in the shore office from directive to supportive roles in their relationships with the shipboard management. The commercial and managerial role of shipboard personnel will therefore increase and MET need to extend into these areas.

4.2.3 Shipping environment

There is now an optimistic mood in the shipping industry and confidence is growing. After a massive sell off and scrapping of tonnage in the early eighties, we now see a sharp increase in scrapped prices. The world merchant shipbuilding orders book

[14] E.G. Frankel, Professor, Massachusetts Institute of Technology-USA, Visiting Professor WMU, paper "Structural Adjustment and Integration of Ocean Shipping" delivered at Singapore Polytechnic, 13 January 1988.
continued to rise in the third quarter of 1989, reaching the highest level since 1984. Lloyd’s Register shows that ships under construction and on order in the world at the end of September 1989 totalled 29.6 million gross tonnes (2430 ships). This was an increase of more than 2.3 million gross tonnes compared with the end of June, already up by 2.2 million gross tonnes from the first quarter’s figure of 25.1 million gross tonnes.[15] It is not within the limited scope of this project to analyse in detail the degree of sophistication of these ships with respect to manning practices and education of personnel. It is however very clear that these ships are costly and that the crew reduction measures through automation and advanced technology, which had their genesis during the recession, is not about to be reversed.

As these new ships start operating and as the existing technically advanced ships come on the second hand market there will be competition amongst the world registers for them. There is a relative shortage worldwide of competent and well-trained seafarers and the country that can provide attractive registration conditions, good infrastructure and a good supply of competent and well-trained seafarers will probably win the day.

Another aspect of the changing environment is that shipping has become an integral link of intermodal transport chains.

6. Zade, "Shipping is no more an independent and isolated industry.... Intermodal transport has reduced the weight and importance of particularities in shipping which made this part of the transport industry

And in a similar vein, E.G. Frankel, "Shipping traditionally operated by specialized shipping companies is increasingly integrated into intermodal transport or consolidated in distribution or large-scale trading and industrial firms." Frankel estimated that less than 30% of world shipping is owned by pure shipping interest, while 32% is owned by trading and integrated transport companies, 16% by shippers, consignees, or other cargo owners, and the rest by governments, their agents, or non-shipping investors.[17]

4.2.4 International Rules and Regulations

Perhaps related to the environment, is that shipping is becoming more regulated. International Conventions and Codes which are developed through United Nations specialist agencies such as UNCTAD, ILO, IMO and others have created an international regime which world shipping is increasingly required to operate within. Conventions and Codes such as Safety of Life at Sea, 1974(SOLAS '74), Protocol to the Tanker Safety and Pollution Prevention 73/78(Marpol 73/78) and Standards of Training, Certification and Watchkeeping for Seafarers, 1978(STCW '78) have major impacts on world shipping and have influence designs, operations, Manning and training. IMO's "Safe Ships and Clean Seas" are widely supported internationally especially in

[16] G.Zade, Professor, Vice-Rector and Academic Dean World Maritime University, paper "The Training of Merchant Marine Officers - what challenges have been and have to be met?", Le Havre, 1989.

the light of recent disasters like the Exxon Valdez. More stringent control will increased through the establishment of "Port State Control". All these will have some repercussions on MET. The main task will be the incorporation of the majority of short courses that had been increasing into the basic courses in order to take maximum advantage of national education votes and so as to be least disruptive as possible for employers and seafarers alike.

4.3 Necessary Response of MET

In the earlier sections, the pressures and their sources bearing on the MET system were identified. Some of these pressures are unique only to Singapore and others are the result of global trends in shipping. A few of the traditional maritime nations whose MET had been affected much earlier by these pressures and global trends have responded by the restructuring of MET in their countries and the benefits of their experience is worth studying.

Many maritime experts who are associated directly or indirectly with MET had also written much on the topic, offering their opinions and suggestions on how and what should be the responses of MET to the pressures and trends affecting it. While broad consensus is present, there are also many opposing views.

Helmut Sohmen, "There are calls not only for a change in the approach of shipowners, but also academics, in developing a more broadly-based practical education system for seafarers, rather than a concentration on degree courses which restrict intake, require long periods of study to be followed by the
necessary apprentice at sea, thus deferring the time when the graduate can expect to be fully competent and receive a salary. We should see training for the merchant marine more as vocational training than as academic study, and revert to an on-the-job training policy for deck cadets and engine-room ratings...".[18]

Jose Femenia, "My thesis is that the preparation of the merchant marine officer for the 1990's will take more education than training."[19]

In restructuring MET, the choice between more training or more education needs to be considered.

Depending on society's perception of MET existing in each country, there may be the need to make seafaring more attractive. MET may have to be integrated into national schemes of further education and provide avenues for seafarers to obtain diplomas, advanced diplomas and degrees in addition to professional certificate of competency.

As research and experience had shown, more and more seafarers tend to look at seafaring as only a temporary career and as a mean of getting the practical experience which he hope will put him in good stead when he finally settled for a shore job in the maritime industry. If a prospective trainee fails to see the light at the end of the tunnel he will be put off. The fact that many who risk themselves eventually end up


71
ashore may be an argument for those who think that the present form of MET had unwittingly took care of the ship-shore bivalency. However, how many good young person who would otherwise have gone to sea if only they could see a coherent and planned career structure from sea to shore and how much more will the maritime industry benefit from the injection of sufficient supply of properly trained people into the industry demand serious consideration. If the MET in a country accepts this philosophy, then more law, and commercial, business and economics subjects will have to form part of the MET curriculum.

Advanced technology, computers, EDI and automation introduced by shipowners aboard ship in the hope to exchange for economic gains through the reduction of crew and new attitude to shipboard practices is well known. Complete or part deck-engine bivalency in the education and training of seafarers demand new responses from the MET system. This shift in the crewing matrix will compound the major shift in maritime educational needs. If a country’s MET accept this method of training, then knowledge-oriented subjects will in general become more technical and basic science and methodology-oriented subjects will require more curriculum hours.

The pros and cons of a "sandwiched" as oppose to a "front-loaded" MET system have been discussed by many and on the whole the "front-loaded" system have gained more acceptance. In Singapore for example, where pressure to reduce cost of MET exist, a shift to the "front-loaded" system may be the alternative for the nautical studies. This will take maximum advantage of national educational votes for its students, be more in line with the overall polytechnic’s policy of three-year diploma courses which can then incorporate the
advanced diploma at a later stage, theoretical and knowledge-based up to the highest professional qualifications can be completed in the early stages and will ensure minimum disruption for shipowners and graduates.

In conclusion, it is wise to heed the advise of D.M. Waters who is a reknown maritime expert in maritime policy and education, "In both regulatory and training requirements where change has, until recent years, been minimal, it is suggested that flexibility should be the key word in planning for the more rapid changes in years ahead."[20]
Shipping is an international business. Ship officers coming from various countries interact at sea. It should not matter which MET system the ship officers went through – all must be well trained. Nearly all the countries with maritime interest are already parties to the IMO’s, Standards of Training, Certification and Watchkeeping for Seafarers Convention, 1978 which gives guidelines on the minimum required standards for MET. An analysis of MET systems of different countries with proven tradition of well trained ship officers should reveal salient features in their curriculum which is common to all systems. These common features can then form the basis from which a MET system may be developed or from which an existing one may be modified.

In this chapter, a study is made of MET systems of selected countries which since 1967 have had the problem to re-examine and restructure their MET in response to the pressures for change as described in Chapter Four. The study revealed two main approaches to the problem. The first is the adoption of a dual-purpose scheme like in the French MET system which in the longer term have been proven to promote ship-shore mobility and the second is the revision of the MET curriculum to incorporate subjects that promote ship-shore mobility of its graduates while maintaining the monovalent approach to training like in the Australian MET system.
The selected countries are the United States of America (USA), France, the Netherlands and Federal Republic of Germany (FRG) which have dual-purpose schemes, and the USA and Australian monovalent schemes for deck officers. Comparison is also made with the Singapore MET for deck officers.

Content of this chapter is as follows:

5.1 Introduction.

In this sub-chapter a brief introduction of the MET systems of each country is described.

This is then followed by a comparison between the different systems which covers the following aspects:

5.2 Schooling and Academic Requirements

In this sub-chapter a comparison of the schooling period and main academic subjects required for entry into the maritime academy is made.

5.3 Sequence of MET

In this sub-chapter the sequence of MET from entry into a maritime academy to the highest certificate of competency level is described. This sub-chapter is divided into: 5.3.1 "Dual-Purpose scheme" and 5.3.2 "Monovalent (deck officers) scheme".

5.4 Content of MET

This sub-chapter is divided into:

5.4.1 "Comparison of total teaching hours" where the total absolute teaching hours utilise by the selected
countries in their shore-based studies is compared.

5.4.2 "Analysis by subject groups between the different countries" where the distribution of the teaching of each subject groups in absolute hours for each country adopting the dual-purpose scheme and the monovalent (deck officers) scheme is analysed, and

5.4.3 "Analysis of subject groups within individual system" where the percentage distribution by subject groups within individual country MET system is analysed.

5.5 Organizational Shipboard Structure and Allocation of Regular Bridge Watch Hours Based Upon the Dual-Purpose Officers as Proposed by Some Countries.

In this sub-chapter a description of the proposed utilisation of dual-purpose officers aboard ships of the Federal Republic of Germany and the Netherlands is described.

Terminologies

Terminologies which can be quite confusing such as bivalent, semi-bivalent, polyvalent, fully-integrated, semi-integrated, dual-purpose and dual-licence are often loosely used to describe the different MET systems, qualification of ship officers and shipboard practices.

There is often a difference between what a ship officer is able to do by qualification and which of his/her qualifications is used during a certain period of time (voyage). For example in France, a ship officer of the highest level certificate is qualified in both the deck and engine disciplines but is restricted by law and must sail either as a deck officer or as an
The writer hope that these confusions will be avoided by defining the terminology used in this chapter as follows:

1. **Training schemes and qualifications of ship officers**

**Dual-Purpose or Dual-Licence scheme/programme**: The form of MET which leads to a combined deck and engine licence.

**Dual-Purpose Officers**: A ship officer which graduated through the dual-purpose scheme and is qualified and licenced to do the functions of a shipboard deck and engineering officer.

In some systems, the officers are qualified and licenced in both the deck and engine disciplines up to the highest Certificate of Competency and is called the "fully-dual-purpose officers" or the "fully-integrated officers". In other systems of MET, the officers are qualified and licenced in both the deck and engine disciplines up to the first level of Certificate of Competency only and are then called "semi-dual-purpose officers" or "semi-integrated officers".

**Monovalent scheme/programme**: This refer to the traditional form of MET which leads to qualification either as a deck or engineer officer. Where it is required to be more specific, the term deck or engine will be added, e.g Monovalent(Deck Officers) scheme.

**Monovalent Officers**: A general term referring to traditional ship officers who are qualified and licenced either in the deck or engine disciplines.
Where it is required to be more specific, the term deck or engine will be added, e.g. monovalent(deck) officers or simply deck officers.

2. Shipboard practices

Fully-integrated ship: This refers to shipboard practice where job functions of both the deck and engine departments is integrated up to the highest level and perform by dual-purpose officers.

Semi-integrated ship: This refers to shipboard practice where job functions of both the deck and engine departments is integrated at the lower level only (e.g. watchkeeping officers level) and perform by dual-purpose officers.

Non-integrated or Conventional ship: This is a term referring to traditional shipboard practice where the functions of the deck and engine departments is kept distinct. The qualifications of the officers can either be monovalent or dual-purpose. For example, in France, the dual-purpose ship officers are restricted by law from performing a dual-purpose functions onboard and are only allowed to sail either as a deck or engineering officer per voyage.

Thus, we may described a French ship officer as fully-dual-purpose but will only work onboard conventional ships. The French MET system is a dual-purpose scheme up to the unlimited certificate level and the USA MET system is a dual-purpose scheme up to the watchkeeping certificate level only.
5.1 INTRODUCTION

5.1.1 USA – The U.S. Merchant Marine Academy, Kings Point, New York

The Kings Point Merchant Marine Academy is a residential academy for the education and training of merchant navy officers. It is autonomous in developing its own scheme of education and training. The dual-purpose scheme has been in existence for many years and is running parallel with the monovalent scheme.

The subject of analysis are the Dual-Licence programme (started since 1964) which produces graduates who are semi-dual-purpose officers and the Marine Transportation programme for deck officers.

The Dual-Licence scheme at Kings Point is administered jointly by the departments of Engineering and Transportation. Graduates of this programme received professional preparation as both deck and engineering officers, leading to licensing by the U.S. Coast Guard as both third mate and third assistant engineer. In addition, the graduates are awarded the Bachelor of Science (BSc.) degree for their academic achievements.

With the current trend towards reduced manning on commercial vessels, the dual-licence graduate is considered qualified to fill shipboard positions requiring skills in both disciplines. Over the years, graduates of the scheme have proven themselves in a wide variety of management positions ashore which require both their professional and technical knowledge.
The Marine Transportation programme prepares the graduates to become deck officers. It leads to the a third mate licence issued by the U.S. Coast Guards and a BSc degree for the academic achievements. This programme provides for the technical and professional skills needed by deck officers in two concurrent and interrelated curricula, nautical science and maritime business administration. In both curricula, the required courses are supplemented with a wide variety of electives.

The Dual-Licence and Marine Transportation programmes have a common entry and both schemes take four years to complete and consist of three years of schooling and one year of sea-service. In the USA system, the academic year is divided into four quarters of about 12 weeks each. The terminology used to describe each of the academic year starting from the first year are Freshmen, Sophomore, Junior and Senior. Midshipmen interested in the dual-licence programme apply for admission during the second quarter of their freshmen year. The competition is very keen and only midshipmen demonstrating above average academic performance during their first two quarters of their freshmen year at the Academy are admitted into the programme which commences from their sophomore year.

As far as the writer can determine, dual-purpose graduates are not employed in integrated capacity onboard USA merchant fleet due to the strong opposition of the labour union and the presence of a restrictive labour law.
5.1.2 France

The dual-purpose program for students of the highest and unlimited certificate was first introduced at the Ecole Nationale de la Marine Marchande, ENMM, in Le Havre in 1967. The scheme had proven itself a success over the last ten years and today the French dual-purpose system is heralded by countries in Western Europe as one of the most advanced and future orientated system in the world. The French dual-purpose system is a subject of study by countries who are considering to introduce dual-purpose elements into their MET system. Dual-purpose MET for the highest certificate is now offered in Le Havre, Marseilles and Nantes.

One of the reasons that spurred the development of the dual-purpose system in the late sixties was the intentions to increase the professional mobility of the ship officers ashore and onboard ships. In the previous monovalent scheme, the chief engineers had better opportunities than the masters to come ashore. The objective has been fully met and according to estimates some 80% or more of graduates holding professional certificates have found lucrative employment ashore in the maritime fields.

In 1986, the dual-purpose scheme was extended to the monovalent second class certificates of competency for masters and chief engineers at the marine academy in Nantes, St. Malo and Le Havre. The intentions is to attract more and better applicants into this level of MET. Whether the graduates of this level will enjoy the same degree of ship-shore mobility as the first class graduates remains to be seen when the first batch of this new dual-purpose graduates complete their training from 1997 onwards.
Unlike in the USA, the control on MET in France is nationally centralised. Onboard the French fleet, a similar situation as that found in the USA exist. The shipboard practice have remained monovalent per voyage due to the strong influence of the unions and French labour laws.

5.1.3 The Netherlands

The semi-dual-purpose scheme for the training of ship officers was implemented in the Netherlands in 1986. The system is nationally centralised and today all maritime colleges have adopted the same scheme.

The main reason for the introduction of the semi-dual-purpose scheme seems to have been the economic survival of the Dutch fleet. Demands from the Dutch shipping companies in the beginning of 1980 for the rationalisation and harmonization of deck/engine training had been very strong. The training institutions and colleges had to quickly adapt the then existing training programmes to the new requirements for multi-skilled ship officers in view of making reduced manning aboard new Dutch ships possible.

Therefore, unlike in France and the USA, the shipboard practice is semi-integrated and received the support of the unions. At present the Dutch officers are still semi-dual-purpose unlike in France where the officers are fully-dual-purpose. The scheme is still in the infant stage and the first group of students are about to or just graduating and monitoring of the scheme in order to measure its success is still being done. In the meantime full-integration of the officers
and a fully-integrated shipboard environment is being planned. It also remain to be seen if the new scheme will promote rapid ship-shore mobility of the ship officers as experienced in France.

5.1.4 Federal Republic of Germany - Hamburg School of Maritime Studies

The Federal Republic of Germany is the latest West European country to implement the dual-purpose scheme for the highest qualification and certificate of her ship officers. However, unlike in the Netherlands and France the system is not nationwide and the scheme is only available at the Hamburg Polytechnic School of Maritime Studies. Other institutions such as the maritime department of the Bremen Polytechnic for example have retained the monovalent system of MET and have opted for a post-graduate scheme where the deck and engineering officers can acquire opposite licence.

The Hamburg Polytechnic's dual-purpose programme was implemented in September 1989 and is still in an experimental stage which probably explain why the dual-purpose system have not been adopted nationwide.

The dual-purpose programme has had its genesis from the results of the national "Ship of the Future" research project which was completed in 1986. Soon afterwards, the Hamburg School of Maritime Studies began to work out the dual-purpose scheme which was completed in 1987. Implementation of the scheme was delayed while further negotiations with all participating parties — authorities, unions and federations were taking place.

Present negotiations with the German Ministry of
Transport are still going on as to the kind of licence that will be issued to the graduates of the new training. The present designation that seem to have been accepted for the graduates of the new scheme is the Ship Operating Officer (SOO) and they will for the time being be issued with both conventional deck and engine licences.

It is still too soon to assess the outcome of the new scheme but for those who are involved in the development of MET, the Hamburg School of Maritime Studies experiment will provide an interesting and important subject of study over the next decade.

5.1.5 Australia - Australian Maritime College (AMC)

Australia like Singapore had inherited a MET based on the system of the United Kingdom. Up to 1980 the examination and certification structure had not differed very much from both Singapore and the UK. However by the late seventies, the UK was well on the way to developing maritime diploma and degree courses within its national education system. There was a growing awareness in Australia that their maritime training were lagging behind those of other countries. At the same time there was also a growing awareness of the need for rationalisation of scattered and expensive facilities for the relatively small number of trainees. This led to the formation of a central maritime college for Australia at Launceston, Tasmania with the proclamation of the Maritime College Act in October 1978.

Since then, the Australian MET system has developed quite differently from both the UK and Singapore. The nautical curriculum for example
encompasses commercial and managerial work not required for the certificates of competency and leads to a recognised educational qualification and an improvement in ship/shore mobility. The Australian MET has managed to some extend to bring their education and training within the national system of education.

The subject of analysis is the Diploma and Degree course in Nautical Science. Materials for this analysis are taken from the AMC's Educational Specification which was introduced when the college was established in 1980. The objective of the course was to provide the trainee deck officer with a comprehensive course of education and training as a basis for future executive responsibility both ashore and afloat. The full degree course as proposed consist of four academic year, but the first three years is covered by the Diploma course in Nautical Science. The fourth year which is made up of one semester (30 weeks) is the degree year which is intended to be optional as the students may instead of continuing their studies in the fourth year choose to proceed to sea and pursue only the CoCs after obtaining their diplomas. It was also possible for them to join the degree programme at a later stage. The curriculum for the degree programme is designed particularly for deck officer aspirants to senior positions ashore, associated with the shipping industry.

Note: The writer wish to point out that the present deck officers education and training scheme at the AMC is quite different from the original proposal which is being analysed in this project. This is because, since the proposal was made in 1980, the MET system at the AMC have been changed many times. There are many opposition mainly by the industry towards providing a broad-based education and awarding academic degree to deck officers. There were also at first a general reluctance to depart from the traditional UK "sanwiched" style of training. Today, the sea-time has been reduced to 18 months before the award of the second mate CoC and coincides with the diploma award instead of after the requirement of from four to five
months sea-time following the diploma programme as in the original proposal (see Figure 5.3, page 95 which shows 'the original proposed MET sequence for Australia). A common entry for ratings, deck and engineering students are also being introduced. Ten years after it was first proposed, discussions are still taking place nationally for the degree award based on the diploma programme and indications are it is likely to be accepted. This is not surprising as MET in many countries are steep in traditions and any new scheme will usually meet with strong resistance. The original proposal contain many salient features which are worth considering. For this reason, the scheme is selected by the writer as one of the subject of comparative study of various national MET systems.

5.2 Schooling and Academic Requirements for Entry into a Maritime Institution for the Highest Level of MET

There exist a variety of terminology in the various countries which are used to describe the three stages of young persons schooling life prior to their admission into a maritime academy or university.

Primary and elementary have been used to describe the first six years (commencing at age six or seven) of a child school life. Secondary and junior high normally cover the period between the seventh and tenth year of schooling and, pre-university, senior high and post-secondary have all been used to describe the period after the tenth year and prior to admission into a maritime academy or university.

For the purpose of this chapter, the terminology adopted for the three phases of school life are primary, secondary and high school respectively.

Table 5.1 show the main subjects and other specific admission requirements into a maritime institution for the highest level of MET.
Table 5.1 - Main Subjects Required and Other Admission Requirements[1]

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>USA</td>
</tr>
<tr>
<td>Mathematics</td>
<td></td>
</tr>
<tr>
<td>Science</td>
<td></td>
</tr>
<tr>
<td>English</td>
<td></td>
</tr>
<tr>
<td>French</td>
<td>Scholastic Aptitude Test (SAT) or American College Test (ACT)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics</td>
<td></td>
</tr>
<tr>
<td>Science</td>
<td></td>
</tr>
<tr>
<td>English</td>
<td></td>
</tr>
<tr>
<td>Dutch</td>
<td></td>
</tr>
<tr>
<td>Mathematics</td>
<td></td>
</tr>
<tr>
<td>Science</td>
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</tr>
<tr>
<td>English</td>
<td></td>
</tr>
<tr>
<td>German</td>
<td></td>
</tr>
</tbody>
</table>

[1] Table drawn from information given by each institution.
Figure 5.1 compares the schooling period for each country prior to admission into a maritime institution and following a course which leads to the highest qualification in the CoC.

Except for the FRG, all countries have a uniform period of six years for their primary education, four years for secondary and two years for high school. In the FRG the period is four years, six years and two years respectively. The total period of schooling from primary to high school (12 years) is the same for all countries. Except for Singapore, all the other countries require the students to complete high school and possess high school certificate of education with compulsory credited passes in mathematics, science (physics), English and national language. In addition, the USA require their new entrants to sit and pass either the Scholastic Aptitude Test (SAT) or the American College Testing Programme (ACT) and in the FRG the entrants must have serve aboard ships as ship-mechanics (similar to general-purpose) for at least 2.5 years.

In Singapore, the requirements for the deck officers course are the completion of secondary schooling and the possession of secondary school certificate with compulsory credited passes in mathematics and the English language. A good pass in science is preferable but not compulsory and a student may substitute science with other subjects.

It should also be noted that Singapore only award a diploma in addition to CoC while all the other countries (Australia under discussion) award a degree in addition to the CoC.
Figure 5.1 - Primary and Post-Primary Education of New Entrants Joining the Highest Level MET in Each Country [2]

[2] Figure drawn from information given by each institution.
5.3 Sequence of MET

5.3.1 Dual-Purpose scheme

Figure 5.2 shows the sequence of MET for the USA, France, the Netherlands and FRG from entry into the system up to the highest certificate level.

From entry to the award of the first level CoC.

In the USA, France and the Netherlands, the dual-purpose schemes take four years starting from entry into a maritime academy up to the first level of CoC and an award of a degree for the USA and the Netherlands and a lower diploma for France. This consist of three years of shore-based studies and about one year of practical sea-service onboard ships. The sequence of alternating between shore and ship varies from country to country. In the USA, the one-year sea service is split into two six-month periods each at the end of the first and second year of shore-based studies. In France, four months of sea-service as merchant marine cadets is done during the first two years and the major portion of the sea-service (10 months) is at the end of third year of shore-based studies. In the Netherlands the one year sea-service is completed in one stretch at the end of the second year of shore-based studies.

In the FRG the duration takes longer. Because of the common entry with ratings, all officers have to serve as ship-mechanics aboard ships for a minimum of 2.5 years. This is followed by four years of shore-based studies at the end of which the students is awarded a diploma (degree) for their academic achievement. They will then need a further 1.5 years sea-service as ship operating officer trainee before
Figure 5.2 - Sequence of MET for the Dual-Purpose Scheme [3]

USA

1 year
6 mths
1 year
6 mths
1 year

BSc & Dual-Licence
(3rd Mate/3rd Eng)

1 year
1 year
1 year

2nd Mate
1st Mate
Master

2nd Eng
1st Eng
Chief Eng

France

1 year
1 year
1 year
1 year

Dual-Purpose Watchkeeper's Licence

Lower Dip

4 mths (1+3 or 2+2)

10 mths
1 year
3 years (min 10 mths each in deck & eng)

Higher Dip

Legend: [ ] sea-service [ ] shore-based [ ] refresher course [ ] min 3 mths each in deck and engine
Legend:  
- sea-service  
- shore-based  
- refresher course

[3] Figure drawn from information given by each institution.
the award of the first level CoC. The total duration from entry to the first level CoC is eight years which compare to the other countries (about 4 years) is very much longer. Future plan is to abolish the 1.5 years sea-service as SOO trainee and award the SOO licence at the end of the four-year shore-based studies together with the academic diploma (degree).

From first level CoC to the highest level CoC.

After the first level CoC, the systems vary remarkably from one another. In the USA and the Netherlands, the system is semi-dual-purpose, i.e. it is integrated only up to the first level CoC (semi-integrated) and then specialisation into deck or engine at the higher level takes place. A main difference between the two country’s system is that in the USA the shipboard practice remains conventional, i.e. graduate of the scheme may sailed either as third mate or third engineer at a time with a distinction of deck and engine in their job functions. They then progress upwards into the highest level of CoC as Masters or Chief Engineers, requiring one year of sea-service in between each level of CoCs, which are the 2nd Mate or 2nd Engineer, 1st Mate or 1st Engineer and Master or Chief Engineer levels. The ship officers need to attend between four to six weeks of refresher course ashore at each level. In the Netherlands however, the shipboard practice is semi-integrated for the first two years after the first level certificate. The officers automatically obtained their CoC either as 2nd Officer or 2nd Engineer depending on their choice of specialisation in their final year of shore-based studies and after another two years of sea-service and four to six weeks of refresher course ashore automatically obtained their CoC as 1st Officer (Master) or 1st Engineer (Chief Engineer).
In France and FRG, the qualification is fully-dual-purpose. A main difference between the two countries is that in France the officers only serve either in the deck or engine department at a time and need to alternate between the two departments. In FRG, the system which at the moment is being planned for the Hamburg Polytechnic SSO graduates is that the shipboard practice will be integrated right through to the highest level of CoC. Another important difference is that in FRG the theoretical knowledge up to the highest level of CoC is completed during the four years (8 semesters) of continuous shore-based studies and only another 36 months of sea-service as SSO is needed in order to obtain the highest level of CoC. In France on the other hand, after 10 months sea-service as watchkeeping officer of which at least three months each is spent in deck and engine departments, one more year of shore-based studies is needed for the award of the Highest Diploma (equivalent to a Degree) and to be followed by another 36 months of sea-service of which at least 16 months each is to be spent on deck and in the engine departments before obtaining the highest level of CoC.

5.3.2 Monovalent (deck officers) scheme

Figure 5.3 shows the sequence for the monovalent (deck officers) scheme of the USA, Australia and Singapore up to the highest level CoC.

The first apparent difference is that both the USA and Australia award a degree and Singapore awards only a diploma and that both countries attempt to complete all theoretical knowledge up to the highest CoC level in the initial stage of the total programme.
Figure 5.3 - Sequence of MET for Monovalent (Deck Officers) Scheme [4]

USA

1 year  |  6 mths  |  6 mths  |  6 mths  |  1.5 years | 3rd Mate Licence

1 year  |  1 year  |  1 year  |          |            |

2nd Mate Licence  |  1st Mate Licence  | Master Licence

Diploma Programme

33 wks + 32 wks + 20 wks +
40 weeks 4 wks T/V 10 wks 3 wks T/V 26 wks 1 wk T/V

Optional (Degree Programme)

30 wks

Degree

Legend:

- shore-based
- net
- sea-service

T/V: training vessel

4-5 mths  |  three years  | Master Cl.1 CoC

2nd Mate CoC
Figure 5.3 (cont'd)

Legend: — shore-based  [ ] sea-service

[4] Figure drawn from information given by each institution.
Apart from the four to six weeks refresher courses before each level of CoCs in the USA and about eight weeks before the Master Class 1 CoC in Australia, the USA and Australia complete all the theoretical knowledge up to the highest level of CoC during the three years and about two and one-half years of shore-based studies respectively at the beginning of the programme. In Australia only a further completion of thirty-six months sea-service is required for the issue of the Master CoC. In the USA, twelve months of sea-service and passing of an examination between each level of CoCs is required.

The system for Singapore has been described in detail in Chapter Two.

5.4 Content of MET

5.4.1 Comparison of total teaching hours

Figure 5.4 compares the absolute total teaching hours of shore-based studies needed to complete all the theoretical knowledge up to the highest CoC for all the countries described in this chapter.

(NB: 1. The total teaching hours for Singapore is calculated by adding the hours utilised for the shore-based teachings of the Pre-Sea Course, the Class 3(2nd Mate) Preparatory Course, the Class 2(1st Mate) Preparatory Course, the Class 1(Master) Preparatory Course and all the compulsory modular short courses.

2. The equivalent of one teaching hour varies slightly from country to country. In FRG it is 45 minutes, Netherlands 50 minutes, France, USA, Australia and Singapore is 60 minutes. For the purpose of this chapter, the absolute teaching hours is used in the analysis.)
Figure 5.4 - Comparison of Total Teaching Hours Utilised by Each Country [5]

[5] Figure drawn from information given by each institution.
The absolute total teaching hours required for the completion of all theoretical knowledge up to the highest CoC level by the dual-purpose scheme of the Netherlands is 2,800 hours spread over three years of shore-based studies. The FRG uses 2,781 hours which is spread over four years of shore-based studies. The USA utilises 3,324 hours over a three-year period of shore-based studies. The average for the three countries is about 2,968 hours.

In France, after the initial shore-based studies, the graduates return to the academy after 10 months sea-service as watchkeeping officers to complete their studies for the Diploma of Higher Merchant Marine(Degree). During this one year, the emphasis is on professional subjects. The total hours needed to complete all theoretical knowledge up to the highest level of CoC is 3,848 hours spread over about four years of shore-based studies.

The average for the four countries adopting the dual-purpose scheme is therefore about 3,188 hours.

For the monovalent(deck officers) scheme, the total teaching hours required by the USA is the highest with 2910 hours spread over about three years of shore-based studies, the lowest is Australia with 2549 hours spread over about 2.3 years of shore-based studies and Singapore in between with 2660 hours spread over about two years of actual shore-based studies. The average for the three countries is about 2700 hours.

(*** NB: In Singapore the shore-based period is made up of about 5 months Pre-Sea + 5 months Class 3 + 5 months Class 2 + 5 months Class 1 + about 17 weeks for all the modular short courses, i.e. total about 2 years)
5.4.2 Analysis by subject groups between the different countries.

For the purpose of this analysis, the subjects are classified into six groups.

1. Support (Supp) which covers subjects such as English and/or national language, mathematics, science, computer science, electricity, electronics, etc.

2. Nautical (Naut) which covers subjects such as navigation, seamanship, rule of the road, cargo-work, nautical instruments, meteorology, communication etc.

3. Engineering (Eng) which covers subjects such as thermodynamics, electrotechnology, naval architecture, marine power plants, marine automation, marine auxiliaries, marine systems, marine instrumentations, fuels and lubricants, workshop practice etc.

4. Law/Business/Management (L/B/M) which covers subjects such as maritime law, maritime economics, personnel management, business management, marketing, marine insurance etc.

5. Project/Electives (Pr/El) which covers projects, and electives.

6. Others (Oths) which covers subjects not covered in group 1 to 5 such as history, naval operations, humanities, physical etc.

The main difficulty in carrying out an analysis of this type is that the same subjects may have different names in various countries. Also some subjects may be present in one country but not in another, for example in the USA there is a strong bias in humanities. The
writer considers that the subject groups provide a good basis for an analytical comparison of subjects emphasis within each system and between the different countries.

**Dual-purpose scheme**

Figure 5.5 shows the distribution of each subject group by hours for each country adopting the dual-purpose scheme.

**Summarising the salient features:**

1. The hours allocated to engineering is approximately twice that for nautical, between 1,182 to 1,800 hours, i.e. between 37% to 56% of the average total hours.

2. The hours allocated to nautical is less than 1000 hours for all countries except France which needed 1,065 hours. The range is between 588 to 1,065 hours, i.e. between 18% to 33% of the average total hours.

3. Support subjects take between 513 to 786 hours, i.e. about 16% to 25% of the average total hours.

4. Emphasis on law/business/management subjects vary from country to country. The FRG place a greater emphasis with 324 hours followed by the USA(252), France(203) and the Netherlands(58). On average this group takes about 210 hours, i.e. 7% of the total teaching hours.

5. Not all countries require the students to submit projects or have electives options. The Netherlands require a project to be submitted and also offer
Figure 5.5 - Comparison of Total Teaching Hours Utilised for Each Subject Group by Each Country [6]

Dual-Purpose Scheme

[6] Figure drawn from information given by each Institution.
elective subjects and allocates about 175 hours in the final year for this purpose in the time-table. In the FRG the students have to submit only projects. In the USA, projects and electives are not required. Students are however encouraged to choose an elective subject.

(NB: The figure show the hours allocated for project/elective in the Netherlands only because about six hours a week is allocated to the subject in the final year. In the FRG no hours is indicated in the main time-table and presumably the students prepare their projects outside these hours.)

6. The USA place a heavy bias in the Others group compared to the other countries. This reflect the USA philosophy of a balanced education which emphasis on humanities subjects and physical training. Also there is a link with the US navy and graduates earn a commission as Ensign in the US Naval Reserve. This explain the inclusion of naval subjects under this group.

A clearer distribution of each subject group within individual scheme is shown in Figure 5.7 in the later sections.

**Monovalent (Deck Officers) scheme**

Figure 5.6 shows the distribution of each subject group by hours for the monovalent (deck officers) scheme in the USA, Australia and Singapore.

**Summarising the salient features:**

1. There is remarkable difference between the Singapore scheme and those of the USA and Australia which are more closer to each other.
2. The emphasis on Support subjects is the highest in the USA with 690 hours, i.e. 25% of the average total teaching hours, followed by Australia with 576(21%) and Singapore with 424(16%).

3. In the Nautical group, the allocated time for USA and Australia is about 890(33%) hours and 1015(38%) hours respectively. Singapore place a very heavy emphasis in the teaching of nautical subjects with about 2078(78%) hours which is more than twice the time used in the USA and Australia.

4. In the Engineering group, Australia allocated about 396(15%) hours, followed by the USA with about 180(7%) hours and Singapore is the least with about 60(2%) hours.

5. In the Law/Business/Management group the USA and Australia have almost the same emphasis, USA with about 396(15%) hours and Australia with about 363(13%) hours respectively. Singapore only allocated 80(3%) hours to this group.

6. Project/Electives group — In the USA it is compulsory for the students to choose an elective subjects and no written projects are required. About 180(6%) hours is allocated in the time-table for this purpose. In Australia, a written project is required but no hours are allocated in the main time-table. The 135(5%) hours shown in Figure 5.6 is for the two electives subjects in the final (degree) year where the students have the options to either choose a Law/Business/Management or Nautical bias subjects. In Singapore projects or electives is not required.

7. Others group — In this group, the USA has a heavy emphasis for the same reason as mentioned above in the
Figure 5.6 - Comparison of Total Teaching Hours Utilised for Each Subject by Each Country [7]

Monovalent (Deck Officers) Scheme

[7] Figure drawn from information given by each Institution.
dual-purpose scheme. About 564(21%) hours is allowed for this group. Australia allocated about 64(2%) hours and Singapore is an insignificant 18(0.7%) hours.

A clearer distribution of each subject group within the individual monovalent system is shown in Figure 5.9 in the later section.

5.4.3 Analysis of subject groups within individual system

Dual-purpose scheme

Figure 5.7 shows the percentage distribution by subject groups within each country’s dual-purpose scheme. It provides a clearer picture of the emphasis which each country places on the various subject groups. For example, it is evident that FRG places a greater emphasis on L/B/M subjects than the other countries.

Figure 5.8 shows the content of MET and how each subject group is distributed over the shore-based studies period. A general pattern that can be concluded is that the Support group is normally completed in the first year and the first part of the intermediate year. The later part of the intermediate and final year are utilised for the Professional subjects. In general, this also applies to the L/B/M subjects.

(NB: In Figure 5.8, the term Year 1, Year 2 etc does not necessarily mean consecutive years. It means that the duration of shore-based studies are grouped in blocks of about one year and may be interrupted by sea-service requirements, see Figure 5.2.)
USA Dual-Purpose Scheme

Support (23.8%)

Proj/El (0.0%)

Mar.Eng (35.6%)

L/B/M (7.6%)

Naut. (17.7%)

Others (15.5%)

Figure 5.7 - Percentage Distribution of Subject Groups for Each Country [5]
France Dual-Purpose Scheme

- Naut. (27.7%)
- L/B/M (5.3%)
- Mar.Eng (48.8%)
- Proj/El (0.0%)
- Support (17.2%)
- Others (3.1%)
Netherlands Dual-Purpose Scheme

- Mar.Eng (39.8%)
- Naut. (28.1%)
- L/B/M (2.1%)
- Proj/El (8.3%)
- Support (21.9%)
- Others (2.1%)
Figure 5.7 (cont'd)

FRG Dual-Purpose Scheme

[L/B/M (11.7%)]
[M.S/Eng (46.6%)]
[Support (18.4%)]
[Proj/El (0.0%)]
[Non (23.3%)]
[Others (0.0%)]

[8] Figures drawn from information given by each Institution.
Figure 5.8 - Content of MET (Dual-Purpose Scheme) in Selected Countries[9]

**Content of shore-based studies** (USA)

<table>
<thead>
<tr>
<th></th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support</td>
<td></td>
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<tr>
<td>Nautical</td>
<td>192</td>
<td>72</td>
<td>324</td>
</tr>
<tr>
<td>Engineering</td>
<td>268</td>
<td>144</td>
<td>402</td>
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<tr>
<td>Bus/Law/Mngmt</td>
<td>168</td>
<td>84</td>
<td>264</td>
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<tr>
<td>Others</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pro/Electives</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

**Content of shore-based studies** (France)

<table>
<thead>
<tr>
<th></th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
</tr>
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<td>Support</td>
<td>330</td>
<td>150 hre</td>
<td>90</td>
<td>90</td>
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<tr>
<td>Nautical</td>
<td>278</td>
<td>195</td>
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<tr>
<td>Engineering</td>
<td>330</td>
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<td>547</td>
<td>375</td>
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<tr>
<td>Bus/Law/Mngmt</td>
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<td>Pro/Electives</td>
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Figure 5.8 (cont'd)

Content of shore-based studies (Netherlands)

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<tr>
<td>Proj/Electives</td>
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Content of shore-based studies (FRG)

<table>
<thead>
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<th>Year 1</th>
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<th>Year 4</th>
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<td>Support</td>
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<td>Nautical</td>
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<td>486</td>
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<td>Bus/Law/Mgmt</td>
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<td>135</td>
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<tr>
<td>Others</td>
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</tr>
<tr>
<td>Proj/Electives</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[9] Figure drawn from information given from each institution.
Monovalent (deck officers) scheme

Figure 5.9 shows the percentage distribution by subject groups within each country's monovalent scheme and provides an indication of the emphasis each system places on each subject group. It is evident that Singapore places a very high emphasis on the Nautical group, about 100% more than the USA and Australia. This reflects the current philosophy of MET in Singapore of "training for ships" only. The "sandwiched" system of training also contributed to the apparent skewedness towards professional and safety subjects brought about by repetitive coverage of certain subjects.

The USA and Australian MET systems appear to have rationalised the hours needed for the teaching of Nautical group subjects and used the extra hours for the teaching of L/B/M and Support groups subjects. The USA attempts to provide a more balance MET scheme by incorporating a high proportion of subjects in the Others group which includes humanities subjects and also have a higher percentage in the Proj/Electives group than the other countries.

In Figure 5.10, the distribution of each subject group over the duration of the shore-based period is shown. In general a similar pattern as those of the dual-purpose scheme exist for the monovalent scheme of USA and Australia. The Support group is normally completed in the first year and the first part of the intermediate year(s) and the Nautical and L/B/M groups in the second part of the intermediate and final year.

(NB: 1. In Figure 5.10, the term Year 1, Year 2 etc does not necessarily mean consecutive years. It means that the duration of the shore-based studies period are group in blocks of about one year and may be interrupted by sea-service requirements, see Figure 5.3. Where
(1/2 year) is indicated the year is made up of about 6 months only. For example, in the Australian scheme, Year 1, Year 2 and Year 3 are all (1/2 year) blocks and the writer avoided combining for example Year 1 and Year 2 as a single block. This was done because it was more convenient for the writer to analyse and draw the figure from the information available.

2. For Singapore the blocks is divided into Pre-Sea, Cl 3, Cl 2 and Cl 1 instead of Year 1, Year 2 etc. This is also done for convenience as Singapore has a "sandwiched" MET system for deck officers. Each block is about six months.)
USA Monovalent (Dk. Off) Scheme

Figure 5.9 - Percentage Distribution of Subject Groups for Each Country [10]
Australian Monovalent (Dk. Off) Scheme

- Others (2.5%)
- Naut. (39.8%)
- Mar.Eng (15.5%)
- L/B/M (14.2%)
- Proj./El (5.3%)
- Support (22.6%)
Singapore Monovalent (Dk. Off) Scheme

- Naut. (78.1%)
- L/B/M (3.0%)
- Mar.Eng (2.3%)
- Proj/El (0.0%)
- Others (0.7%)
- Support (15.9%)

Figures drawn from information given by each Institution.
Figure 5.10 - Content of MET (Monovalent Scheme) in Selected Countries [11]

### Content of shore-based studies (USA)

<table>
<thead>
<tr>
<th>Support</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>264</td>
<td>168 hrs</td>
<td>360</td>
</tr>
<tr>
<td>Nautical</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>108</td>
<td>36</td>
<td>36</td>
</tr>
<tr>
<td>Engineering</td>
<td>36</td>
<td>216</td>
<td>144</td>
</tr>
<tr>
<td>Bus/Law/Mngt</td>
<td>132</td>
<td>228</td>
<td>204</td>
</tr>
<tr>
<td>Others</td>
<td></td>
<td></td>
<td>160</td>
</tr>
<tr>
<td>Proj/Electives</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Content of shore-based studies (Australia)

<table>
<thead>
<tr>
<th>Year 1 (1/2 yr)</th>
<th>Year 2 (1/2 yr)</th>
<th>Year 3 (1/2 yr)</th>
<th>Year 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support</td>
<td>268</td>
<td>288</td>
<td>240</td>
</tr>
<tr>
<td>Nautical</td>
<td>336</td>
<td>304</td>
<td>60</td>
</tr>
<tr>
<td>Engineering</td>
<td>144</td>
<td>192</td>
<td>60</td>
</tr>
<tr>
<td>Bus/Law/Mngt</td>
<td>48</td>
<td>90</td>
<td>225</td>
</tr>
<tr>
<td>Others</td>
<td>64</td>
<td></td>
<td>135</td>
</tr>
<tr>
<td>Proj/Electives</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Content of shore-based studies (Singapore)

<table>
<thead>
<tr>
<th>Support</th>
<th>Pre-Sea (1/2 yr)</th>
<th>CI 3 (1/2 Yr)</th>
<th>CI 2 (1/2 Yr)</th>
<th>CI 1 (1/2 Yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>144</td>
<td>160 hrs</td>
<td>120</td>
<td>460</td>
</tr>
<tr>
<td>Nautical</td>
<td>378</td>
<td>620</td>
<td>620</td>
<td>80</td>
</tr>
<tr>
<td>Engineering</td>
<td></td>
<td></td>
<td></td>
<td>60</td>
</tr>
<tr>
<td>Bus/Law/Mngmt</td>
<td></td>
<td></td>
<td></td>
<td>80</td>
</tr>
<tr>
<td>Others</td>
<td>18</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prys/Electives</td>
<td></td>
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</tr>
</tbody>
</table>

NB: Hours for Nautical subjects in CI 3 and CI 2 includes short courses.

[11] Figure drawn from information given by each institution.
5.5 Organizational Shipboard Structure and Allocation of Regular Bridge Watch Hours Based Upon the Dual-Purpose Officers as Proposed by Some Countries

In this section only the proposal of FRG and the Netherlands is discussed. In the USA and France, shipboard bivalency is not practiced and therefore the organizational shipboard structure and the allocation of regular bridge hours do not differ from the traditional practices aboard monovalent ships.

FRG

Figure 5.11 shows the future organizational shipboard structure for vessels of more than 6,000 GRT based on SOD and without a Radio Officer. The proposed shipboard complement is 12 persons which is made up of a Master, a Chief Officer, three SOD, one Ship Mechanic Foreman, four Ship Mechanics and two Caterers. The term Master and Chief Officer here should not be construed as in the present sense as these are persons coming from the SOD ranks.

Figure 5.12 shows the proposed allocation of regular bridge watch hours and additional working time as a flexible system being adapted to actual workload distribution for ship officers. In this system, the Master have to share the bridge watch workload and the Chief Officer and all SODs spend some hours in technical work.
Figure 5.11 - FRG's Future Organizational Shipboard Structure Based on the SOO [12]

Master
- 4 hrs Bridgewise

Chiefmate
Personnel Management
Work Organization
- 4 hrs Bridgewise

SOO
Cargo
- 6 hrs Bridgewise

SOO
Technical Systems
- 4 hrs Bridgewise

SOO
Navigation Safety & Communication
- 6 hrs Bridgewise

Apprentice & Ship Mechanics
and/or
Foreman & Ratings

Cook
Steward
Catering

**Figure 5.12 - Proposed Allocation of Regular Bridge Watch Hours and Additional Working Time Aboard FAD's Vessel Based on the SOO.**

<table>
<thead>
<tr>
<th>Time</th>
<th>22</th>
<th>00</th>
<th>02</th>
<th>04</th>
<th>06</th>
<th>08</th>
<th>10</th>
<th>12</th>
<th>14</th>
<th>16</th>
<th>18</th>
<th>20</th>
<th>22</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Master</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Chiefmate</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOO Cargo</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOO Tech Svs</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nav/Comm</td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>

**Legend:**
- ■■■■ Additional working time
- ■■■■ Bridge Watch

Figure 5.13 shows the organizational shipboard structure for semi-bivalent Dutch ships utilising the semi-integrated officers and with an expected complement of 16 persons. The Dutch terminology for the dual-purpose officers is Marof or Maroff. This proposal is likely to be implemented onboard suitable automated ships when the Maroff officers start graduating from the new MET system.

The main feature is the rotation of the three Maroffs between bridge watches and daywork so that each one of them will accumulate sufficient experience on shipboard technology and maintenance over the next two years of sea-service before qualifying for their next level of CoC.

Figure 5.14 shows the next stage when the Dutch ships go bivalent and utilising the fully-integrated officers. The expected complement is ten persons. This system is only possible when there are sufficient numbers of Maroffs as the Manager must be a Maroff with considerable experience. It is estimated that by this time, most of the monovalent Masters and Chief Engineers will be finishing their sea careers and that there will be more Dutch ships of modern design and equipped with the latest technology.

Figure 5.15 and 5.16 shows the proposed allocation of the regular bridge watch hours and additional working time of ship officers for the semi-bivalent and bivalent ships respectively.
Figure 5.13 - The Netherlands' Proposed Organizational Shipboard Structure Based on the Semi-Integrated Officers [14]

[14] Figure drawn from information collected during field studies in the Netherlands.
Figure 5.14 - The Netherlands' Future Organizational Shipboard Structure Based on the Fully-Integrated Officers [15]

[15] Figure drawn from information collected during field studies in the Netherlands.
Figure 5.15 - Proposed Allocation of Regular Bridge Watch Hours and Additional Working Time Aboard Dutch Vessels Based on the Semi-Integrated Officers [16]

<table>
<thead>
<tr>
<th>Rotation</th>
<th>Master</th>
<th>Chief Officer</th>
<th>Watch Officer 1</th>
<th>Watch Officer 2</th>
<th>Watch Officer 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
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<td>10</td>
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<td>12</td>
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<tr>
<td>14</td>
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<tr>
<td>16</td>
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<tr>
<td>16</td>
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<td>22</td>
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<tr>
<td>24</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Legend:  - Additional Working Time  - Bridge Watch

[16] Figure drawn from information collected during field studies to the Netherlands.
Figure 5.16 - Proposed Allocation of Regular Bridge Watch Hours and Additional Working Hours Aboard Dutch Vessels Based on the Fully-Integrated Officers [17]

[17] Figure drawn from information collected during field studies in the Netherlands.
CHAPTER SIX

CONCEPTUAL OUTLINES OF TWO PROPOSALS RELATING TO A NEW MET SCHEME FOR SINGAPORE

It is nearly never possible to take a MET of a country and transplant it into another. However, it is useful to look into other countries' systems (Chapter Five) and adapt what is appropriate to local conditions.

MET can continue to develop only if there is a national consensus on its need. The proposals in this chapter is made based on assumption that there is such a consensus.

Summary of the content of this chapter is given below:

6.1 Establishing the Right Objectives for the New MET
   6.1.1 Identifying the different needs and demands
   6.1.2 Harmonizing the different sets of needs and demands
   6.1.3 Characteristics of the new MET system

6.2 Designing the New MET
   6.2.1 Shore-based period
   6.2.2 Entry requirements
   6.2.3 The education structure
   6.2.4 The philosophy
   6.2.5 The scheme
   6.2.6 The content

128
6.3 Concluding Remarks

6.1 Establishing the Right Objectives for the New MET

What should be the education and training (ET) objectives of the new MET system?

Evaluation of the requirements of the several parties which are concerned with MET revealed a set of needs and demands which appear to be often alien to each other. Also external factors such as the changing socio-economic conditions for example, have also been described (Chapter Four) as exerting demands on the MET system. An ideal MET system is one that can satisfy fully the demands and needs of all parties. In reality this can never be achieved. A comprehensive approach is needed to identify complementary factors among the different requirements. The final design will be a compromise that is acceptable to all parties but without compromise to the demand for able and well qualified ship officers.

6.1.1 Identifying the different needs and demands

1. The shipowners as a group is a powerful institution that influence MET in Singapore by acting as sponsoring agents of the graduates. The primary need of the shipowners is a sufficient supply of well trained personnel to man their ships. As sponsoring agents, it is understandable that they want the ET of their "sponsees" to be as short and as cheap as possible. Some view the ET of cadets as a burden on cost and accept it grudgingly because they see no other alternative. In general, they prefer to have "training" which is more directly related to shipboard
task and will view any attempt to provide a general academic education and vocationally transferable training as a waste of resources.

2. The maritime administration (MARAD) as an instrument of the government have public interest to protect. Its policing role ensure that national and international regulations on safety and environmental protection are abided. Their task includes the control of examinations for the proper licencing of shipboard personnel. In general, for a MARAD, the form of MET is of a lesser concern to them for as long as it can be shown that national regulations and minimum international requirements on safety and environmental protection are not jeopardized.

3. The society can be viewed as a source of applicants for MET courses. Their needs and demands will depend on cultural and socio-economic factors. In most countries as well as in Singapore, the pursuit of a higher education is seen as a mean of gaining economic success and status. To compete with training for other sectors of employment, MET must provide its graduates with, and in addition to specialist skills for shipboard use, a flexible education which is a foundation for a continuing education as well as providing meaningful employment prospects should they wish to pursue other careers ashore. Culturally, Singaporeans are not seafarers and do not stay long at sea. Singaporeans are generally business minded. Both are important factors which must be taken into account when designing a new MET system.

4. The Singapore Polytechnic (SP) which is the only institution in Singapore to provide ET up to the highest level of ship officers has to operate within certain
constraints. As a publicly supported institution it receives its budget from the Ministry of Education (MOE). The academic standards of MET courses come under the purview of the MOE and are delegated through the various SP committees. The professional standards come under the purview of the Ministry of Communications and Information and are delegated to the Marine Department. The maritime departments of the SP have the delicate task of balancing the academic and professional requirements for their courses and working within a given cost frame. The period allocated to the teaching of all full-time diploma courses except for the Diploma in Nautical Studies Course is three years running consecutively. Provision for a one year advanced diploma level is provided at a later stage but the course must be self-financing. The shore-based studies of the new MET are required to operate as far as possible within the constraints mentioned.

6.1.2 Harmonizing the different sets of needs and demands

From the above sets of needs and demands generated by the shipowners, MARAD, society and the training institution, the requirements of MARAD and the SP are relatively clear and easier to accommodate. The SP as an ET centre has to ensure that the curriculum and training is at all times relevant to the needs of industries. Above all others, it also has a social obligation of providing a good and flexible education to its students.

The needs and demands of shipowners and society seem to be the most divergent. The two groups represent the "demand and supply" elements (Chapter Three) respectively for MET and while the demand for technical and highly skilled ship officers has been increasing, the supply of
quality entrants has been falling. The reasons for the increasing demand of skilled personnel and the decline of MET applicants have been covered in Chapter Three and Chapter Four. One of the essential elements of the new MET is to balance the needs and demands of the shipowners and the society.

The existing MET and especially the deck officers training have been for a long time pro-shipowners. This is reflected in the curriculum (Chapter Five) and resulted in the graduates having narrow specialist skills for shipboard use. As the fortunes of the shipowners are cyclical the employment of ship officers depend very much on the state of shipping – being highly in demand in good times and usually abandon in bad times. This state of affairs is perhaps the most significant contributor to the decline in the number of quality applicants for MET courses.

The position of Singapore’s maritime graduates is however not unique. The experiences of MET in the USA in balancing the interest of shipowners and students deserve mentioning. The research of Professors Rosengren and Bassis on nautical education in Spain, UK and USA and published in a book entitled "The Social Organization of Nautical Education" is extensively quoted below.

"Two distinct and easily recognizable beneficiaries of maritime training schools are, first, the national political economy and, second, the students...[1]

[1] Professors Rosengren and Bassis, University of Rhode Island, USA, the book entitled "The Social Organization of Nautical School", page 10, para 2, lines 1-5.
From this perspective nautical schools can be seen as an instrument of national purpose. However, such schools can also be viewed as a source designed to satisfy, not the national interest, but the interests of the students. As publicly supported education becomes more and more widespread in these three countries, and as technical education becomes integrated in one form or another into the national systems of higher education, the training received in merchant marine academies is increasingly expected to fulfill the traditional role of education for the student — entrance into the opportunity of the society and fixing a place for the occupant at an acceptable level in the system of social stratification.

Thus, a potential conflict arises between nautical training as an instrument of national-collective interests and as an instrument of the personal interest and social aspirations of students. The problems of reaching a satisfactory accommodation between the two demands are,... particularly acute in this occupation...[2]

In America the quasi-autonomous and independent college form of sponsorship provides the student with primary access to the school as a resource. The American academies are not maintained specifically to further the interests of the sponsoring state governments or private shipping companies but to provide meaningful and useful general education and vocationally transferable training in an effort to ensure that their graduates will be able to find meaningful employment should they decide to pursue

other careers either on land or on the sea. [3]

The broad extension of public supported education is reflected in the now firmly established emphasis on general education in the nautical schools. While they aim to equip the midshipmen to carry out special responsibilities that fall to the officers of oceangoing ships, the schools also ensure that their graduates will be able to claim social rank equal to that of any other American university graduate. [4]

6.1.3 Characteristics of the new MET system

The philosophy of the new MET as reflected in its design should ideally aim for a system:

- which provides education and training for both sea and shore careers,
- which encompasses MARAD requirements and observes all applicable national and international maritime rules and regulations,
- which is integrated in the national education system; in particular the norms of the Singapore Polytechnic,
- which maximises the benefit of the national education vote for its students and move away from the system of sponsorships by shipowners,
- which provides opportunities for a continuing education,


which promotes direct contact with other sectors of the maritime industry,

- which promotes the concept of inter-modal transport, and

- which emphasises innovative and entrepreneurial thinking through a vast understanding of subjects like economics, commercial, management and the workings of the shipping environment.

6.2 Designing the New MET

The approach is to take the normal time allocated to full-time diploma courses at the SP as a starting point and design a curriculum to fit into the time frame. Experts on curriculum design may frown at such an approach but from the writer's experience this often is the case in practice.

6.2.1 Shore-based period

Duration of diploma courses at SP ........ 3 years,
Length of academic year ........ 30 to 34 weeks,
Teaching hours .......... 30 hours of 60 mins per week;
Teaching hours per year ....... 900 to 1020 hours,
Total hours available ...... 2700 to 3060 hours.

Option for one year advanced diploma at a later stage ...... 900 to 1020 hours.

6.2.2 Entry requirements

In addition to the normal medical and eye-sight
requirements, the system will continue to draw students from the GCE "O-level" certificate holders with good credits in English, Mathematics and Science (physics). High school("A-level") graduates are preferred but attracting them will be a major problem. Perhaps a way of drawing them into MET is to make it possible for "A-level" holders to join the studies at the beginning of the second year. This would mean that the teaching of most if not all of the professional subjects will have to be delayed into the second year and therefore modular teaching will be an advantage. If necessary, a preparatory or pre-programme course covering the professional subjects could be provided for the "A"-level holders joining in the second year.

6.2.3 The education structure

Following the norm of the SP, the system should be "front-loaded" and spread over three years of continuous studies. (The writer recommends that 6-12 months of sea-service be incorporated in between the shore-based studies. It will be more in line with the FRG system of polytechnic education, "Fachhochschulen" where vigorous industrial and practical training is emphasised). The main disadvantage as already pointed out lie in the absence of sea-training which is sacrificed for the sake of fitting into the norms of the SP and the national tertiary education system. This shortcoming should be remedied through the extensive use of teaching aids and work simulation exercises to simulate as close as possible shipboard operation. Further investment in training simulators is therefore required.

As much as possible of the theoretical knowledge up
to the highest sea qualification level should be covered in the three-year shore based studies.

The shipowners working hand-in-hand with the SP will have to take greater responsibilities than the present in providing properly planned schedules of practical shipboard apprenticeships.

The MARAD will continue its role of monitoring to ensure that both the theoretical shore-based ET and shipboard practical apprenticeships are carried out to their requirements.

Two distinct levels of knowledge and certification should be defined for both academic and professional achievements which are:

1. academic levels— the diploma and the advanced diploma
2. professional levels — the watchkeeping officer (WKO) and the senior officer (SO).

6.2.4 The philosophy

Two approaches have been identified in Chapter Five — the dual-purpose scheme and the monovalent (deck officers) scheme (with enlargement in basic studies that promote ship-shore mobility). Both systems have their own advantages and disadvantages.

The dual-purpose scheme will widen the scope of shipboard skills of the graduates and indirectly promote ship-shore mobility as experienced in France. However, because of the heavy emphasis on shipboard skills, the system cannot accommodate in the three-year shore-based
studies, subjects that will prepare graduates for a career ashore in the maritime industry. This may create some aversions to prospective applicants for MET courses who may think that they are expected to work onboard ships for the rest of their working life. More economics, business, transport and management subjects will be taught in the advanced diploma stage to make up for the earlier deficiencies. Graduates who are prepared to stay longer at sea would benefit from the broad practical experience and with the advanced diploma should stand in good stead for shore careers in the maritime and transport sectors. The marketing of MET graduates to shore employers is of course vital!

The monovalent (deck officers) scheme should be able to complete all the theoretical knowledge up to the highest sea-going qualification level during the three-year shore-based studies. Because of the lesser emphasis in engineering subjects, sufficient hours is left over for the teaching of economics, business, transport and management subjects which are useful for shore careers in the maritime and transport sectors. The danger could lie in providing a ship-shore mobility too early and graduates may not go to sea or stay long enough. However, if it is accepted that MET should break through the "psychological-shell" imposed by traditions of training for the sea only and take on a role of training for the maritime industry both ashore and afloat then it does not really matter if the graduates remain at sea or not for as long as they are all employed. Retaining them at sea is thus the responsibility of shipowners. Like in other sectors of industry, the shipowners have to compete for the graduates services with other employers. In comparison to the dual-purpose scheme, prospective applicants to the monovalent scheme may see a clear career path from sea to shore and
may be attracted by it. In the advanced diploma stage, more emphasis is given to economics, business, transport and management subjects. Those who are willing to stay longer at sea should well benefit from the practical experience and the advanced diploma studies. Similarly, the marketing of MET graduates to shore employers is vital!

The choice between the two systems is indeed a difficult one. In Singapore, if the dual-purpose scheme is selected, it should initially be for semi-dual-purpose officers as the majority of Singapore shipowners will not be ready for the fully-dual-purpose officers for some time yet. Also the gradual change will allow time for adjustments. The choice will mainly depend on the rate of modernisation of Singapore’s fleet (allowing for reduced manning) which at the moment is difficult to predict. However, the writer is of the opinion that the dual-purpose officers would also be suitable onboard conventional ships if the reduction of officers is not the prime purpose. The benefit should be seen in term of a single shipboard team which is initially made up of junior dual-purpose officers who could be more flexibly employed, and because they are trained to look at ships as a total system, efficiency will improve. Once this stage is reached the reduction in the number of officers onboard could be easily implemented whenever shipowners build or purchase sophisticated ships. The long term evolution will be a single shipboard team of dual-purpose officers up to the highest level.

If we take the experiences of other countries as analysed in Chapter Five, there is not much different in the time used in the shore-based studies for the education and training of monovalent or dual-purpose officers. In
the SP the three-year diploma in addition to the one-year advance diploma seems to offer sufficient time for the adoption of a dual-purpose scheme and therefore no extra time and cost (except for investment in training simulators/aids) is necessary. Only priorities and subject emphasis will be different from the monovalent scheme. Also, if we are to consider that by adopting the dual-purpose scheme, the existing Diploma in Nautical Studies and Diploma in Marine Engineering will give way to a single diploma course the result may be a net saving on cost.

On the other hand if the alternative monovalent (deck officers) scheme is chosen, a choice of students from a wider pool is possible as the emphasis on technical skills is replaced by a wider emphasis in economics and commercial subjects and therefore students with lower credits in mathematics and without science subjects can be considered. The monovalent (engineering officers) scheme will probably continue in the existing form but will also need to consider the ship-shore mobility aspect in their curriculum in order to improve the attractiveness of the course.

At this stage, the writer maintains an open position as to which system is preferable and believes that more discussions among the various parties are required. For this reason, both schemes are described.

6.2.5 The scheme

Dual-purpose scheme

The term dual-purpose in the heading "dual-purpose
scheme" has a double meaning in the context of this section. Firstly, it refers to the dual-purpose education and training and the subsequent dual-purpose professional qualification (CoC) for some graduates. Secondly, the scheme would serve the requirements of two different types of shipowners as described in the following paragraph.

Figure 6.1 shows the proposed dual-purpose scheme.

To cater for two possibilities of shipowners' requirements, two schemes after the three-year shore-based studies are proposed.

1. Scheme A is for shipowners who are planning to modernise their fleet and who are thinking of operating their ships with dual-purpose officers. After the three-year shore-based studies and the passing of examination, a candidate for a dual-purpose qualification requires a minimum of 18 months (nine months accumulated sea-service in each deck and engine departments) sea-service before the issue of the dual-purpose WKO licence. This is then followed by a minimum of 12 months sea-service preferably in dual-purpose capacity. Next is the one year shore-based studies and examination for the advanced diploma and for specialisation into deck or engine for a senior officer licence. A minimum of 24 months sea-service as a Senior Officer is then required before promotion to Master or Chief engineer is allowed.

A slight problem in using a qualified dual-purpose WKO in a dual-purpose capacity is envisaged in the early stages as there are insufficient number of them. For the scheme to work well, each ship must employ a minimum of two dual-purpose officers at any one time. This is because to utilise these officers in dual-
Shipowners operating ships with dual-purpose watchkeeping officers.

**Scheme A**

- Master Ch.Eng
- Minimum 24 months sea-time with SO Licence
- Adv Dip & SO Licence
- 1 year at SP
- Re-join SP
- Minimum 12 months sea-service as WXO
- Issue of WKO Licence
- Minimum 18 months sea-service as dual-purpose trainee officer
- Diploma

**Scheme B**

- Master Ch.Eng
- Minimum 24 months sea-service with SO Licence
- Adv Dip & SO Licence
- 1 year at SP
- Re-join SP
- Minimum 12 months sea-service as WKO
- Minimum 12 months sea-service as trainee

Legend:
- Shore-based study
- Sea-service
- WKO: Watchkeeping officer
- SO: Senior Officer

Possible entry point for "A"-level holders

Year 1

Year 2

Year 3

142
purpose capacity they need to rotate between themselves (the rests will be monovalent officers) from deck to engine and vice versa. Otherwise, the dual-purpose officers will end up being employed in a monovalent capacity either in a deck or engine department.

2. Scheme B is for shipowners who are operating conventional ships with monovalent ship officers. After the three-year shore-based studies and passing the examination, a candidate for a monovalent qualification needs 12 months of sea-service in the deck or engine department before the issue of a WKO licence. This is followed by a minimum of 12 months sea-service as WKO. Next is the one year shore-based studies and examination for the advanced diploma and the senior officer licence. A minimum of 24 months sea-service as Senior Officers is then required before promotion to Master or Chief Engineer is allowed. At anytime after the WKO stage a ship officer may switch to opposite departments by satisfying a minimum of 12 months sea-service in the opposite department and earn second WKO licence in the opposite discipline. Combination of the two WKO licences is equivalent to the combined WKO licence issued under scheme A.

Monovalent (deck officer) scheme

Figure 6.2 shows the proposed monovalent (deck officer) scheme.

After the three year shore-based studies and the passing of examination, a minimum of 12 months sea-service is required before the issue of a WKO licence. This is followed by a minimum of 12 months sea-service as WKO. Next is the one year shore-based studies and
Figure 6.2 - Proposed Structure of Monovalent (Deck Officers) Scheme

Master

- Minimum
  - 24 months sea-service with Senior Officer Licence

Advanced Diploma ---------- & Senior Officer Licence

- 1 year at SP

re-join Singapore ------- Polytechnic

- Minimum
  - 12 months sea-service as WKO

Issue of Watchkeeping ---- Officer Licence

- Minimum
  - 12 months sea-service as trainee officer

Diploma -------

- 3 years shore-based studies at Singapore Poly.
- Possible entry ---- point for "A"-level holders

Legend:
- Shore-based studies
- Sea-service

144
examination for the advanced diploma and the senior officer licence. A minimum of 24 months sea-service as a Senior Officer is required before promotion to Master is allowed.

Could both the dual-purpose and monovalent schemes be implemented at the same time?

An example of a country where parallel offering of both systems is carried out is the Federal Republic of Germany: the dual-purpose scheme at the Hamburg Polytechnic and the monovalent scheme at the Bremen Polytechnic. The Department of Maritime Studies of the Bremen Polytechnic, went a step further by recently implementing a post-graduate scheme where existing ship officers could acquire professional licence in the opposite discipline. Deck officers who wish to obtain a WKO licence in the engineering discipline need to attend a shore-based study of three semesters (about 1.5 years) and engineer officers who wish to obtain a WKO licence in the deck discipline need to attend a shore-based study of two semesters (about 1 year). After about six months of sea-service in opposite departments the officers are issued with WKO licence in the opposite discipline.

The writer is of the opinion that the implementation of parallel system in Singapore will be difficult. Singapore is a small nation with a population of 2.5 million as compared with FRG's 60 million. Singapore human resources is rather limited and to offer parallel system will dilute further the already small number of applicants into MET. One of the reasons for implementing a dual-purpose scheme is to try and consolidate the good applicants from both the present monovalent schemes (deck and engine) into a
single scheme. Offering of parallel system means that the potential applicants will be split three ways: dual-purpose, monovalent(deck) and monovalent(engine). Parallel system may also create confusion for potential applicants. From past experience, it is found that applicants have difficulties in comprehending even the present MET system and its subsequent employment opportunities.

Is there a need for a post-graduate scheme for existing ship officers upon acceptance of the dual-purpose scheme?

The above question has a social ring to it. It is also a question of needs which hinges on the rate at which dual-purpose officers are utilised onboard ships. This in turn will depend upon the willingness of shipowners to depart from traditional shipboard practices and to implement new ways of shipboard practices.

The writer is of the opinion that to design such a scheme provided there is sufficient demand, will not be too difficult and it should be much easier to get it off the ground than the proposed dual-purpose scheme. The experiences of the Bremen Polytechnic could provide a useful source from which to model the scheme. Ideally the post-graduate scheme should be design in such a way that the curriculum could be nicely fitted into later stages of the shore-based studies of the main stream dual-purpose scheme. The officers may come in at mid-term of the second year or at the beginning of the third year. It may not be necessary for these officers to attend every lecture. The time could be use for more workshop practices, simulator training and tutorials. Designing such a scheme will require in
depth thinking by those responsible for the curriculum. Alternatively, the post-graduate scheme may be separate from the main dual-purpose scheme and form part of a continuing education scheme.

6.2.6 The content

The findings from the analysis of MET systems (Chapter Five) provide reasonable guidelines for subject contents and for this purpose the same categories of subject groups (Others group is omitted) are used.

**Dual-purpose scheme**

Stage 1 – three-year shore-based studies (diploma and covering most of the CoCs theoretical knowledge):

<table>
<thead>
<tr>
<th>Subject Groups</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Support</td>
<td>500–600</td>
</tr>
<tr>
<td>2. Nautical</td>
<td>750–850</td>
</tr>
<tr>
<td>3. Engineering</td>
<td>1350–1460</td>
</tr>
<tr>
<td>4. Law/Businesss/Management</td>
<td>100–150</td>
</tr>
<tr>
<td>5. Project/Electives</td>
<td>not required</td>
</tr>
</tbody>
</table>

Total Hours 2700–3060

(NB: Project/Electives is not required at this stage as the course will be sufficiently demanding without the students having to cope with project as well).
Stage 2 - one-year shore-based studies (advanced diploma and remainder of CoC theoretical knowledge in nautical or engineering specialisation):

Subject Groups
1. Nautical or Engineering specialisation. 400-470
2. Law/Business/Management 500-550

Total hours: 900-1020

(NB: Written project required in addition)

Table 6.1 compares the total teaching hours for each subject group under the proposed dual-purpose scheme with the averaged hours used by the dual-purpose schemes of USA, France, Netherlands and FRG which is described in Chapter Five.

Table 6.1 - Comparison of Teaching Hours Use by the Proposed Dual-Purpose Scheme with the Averaged Hours Use by USA, France, Netherlands and FRG

<table>
<thead>
<tr>
<th>Subject Group: (Dip+Adv Dip)</th>
<th>Singapore</th>
<th>Averaged Hours (USA, France N'lands, FRG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support</td>
<td>500-600</td>
<td>643</td>
</tr>
<tr>
<td>Nautical</td>
<td>1150-1320 (750-850)</td>
<td>773</td>
</tr>
<tr>
<td>Engineering</td>
<td>(1350-1460) 1750-1930</td>
<td>1347</td>
</tr>
<tr>
<td>Law/Bus/M'ngmt</td>
<td>600-700</td>
<td>209</td>
</tr>
<tr>
<td>Proj/Electives</td>
<td>***</td>
<td>(44)*</td>
</tr>
<tr>
<td>Others</td>
<td>nil</td>
<td>174</td>
</tr>
</tbody>
</table>

Total Hours: 3600-4080  3190

*** Required but no time allocated in the main timetable.
Only the Netherlands allocate some hours (175) for Project/Electives in the main timetable. The figure (44) is the result of averaging 175 hours by 4.

Figure 6.3 shows the percentage distribution of subject groups in the three-year shore-based studies leading to the diploma level. Figure 6.4 shows the percentage distribution of subject groups in the shore-based diploma and advanced diploma studies of the proposed scheme with deck or engineering specialisation at the advanced diploma stage.

Monovalent (Deck Officers) scheme

Stage 1 - three-year shore-based studies (diploma and covering all CoCs theoretical knowledge):

<table>
<thead>
<tr>
<th>Subject Groups</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Support</td>
<td>600-660</td>
</tr>
<tr>
<td>2. Nautical</td>
<td>1000-1200</td>
</tr>
<tr>
<td>3. Engineering</td>
<td>200-300</td>
</tr>
<tr>
<td>4. Law/Business/Management</td>
<td>700-700</td>
</tr>
<tr>
<td>5. Project/Electives</td>
<td>200-200</td>
</tr>
</tbody>
</table>

Total Hours: 2700-3060

(NB: Written project required in addition)
Figure 6.3 - Percentage Distribution of Subject Groups in the Three-Year Shored-Based Diploma Studies of the Proposed Scheme
Proposed Dual-Purpose Scheme
Deck Specialisation at Adv. Dip

Figure 6.4 - Percentage Distribution of Subject Groups in the Shore-Based Diploma and Advanced Diploma Studies of the Proposed Scheme
Proposed Dual-Purpose Scheme

Engineering Specialisation at Adv. Dip

- Support (14.0%)
- L/B/M (17.0%)
- Pr/El (0.0%)
- Naut (21.0%)
- Mar.Eng (48.0%)
Stage 2 - one-year shore-based studies (advanced diploma and refresher periods for professional subjects):

<table>
<thead>
<tr>
<th>Subject Group</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Nautical (refresher)</td>
<td>200-300</td>
</tr>
<tr>
<td>2. Law/Business/Management (including an elective)</td>
<td>700-720</td>
</tr>
<tr>
<td><strong>Total Hours:</strong></td>
<td><strong>900-1020</strong></td>
</tr>
</tbody>
</table>

(NB: Written project required in addition)

Table 6.2 compares the total teaching hours for each subject group under the proposed monovalent (deck officers) scheme with the averaged hours used by similar schemes of USA and Australia which is described in Chapter 5.

Table 6.2 - Comparison of Total Teaching Hours Use by the Proposed Monovalent (Deck Officers) Scheme with the Averaged Hours use by USA and Australia

<table>
<thead>
<tr>
<th>Subject Group</th>
<th>Hours (Dip+Adv Dip)</th>
<th>Averaged Hours (USA and Australia)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support</td>
<td>600-660</td>
<td>634</td>
</tr>
<tr>
<td>Nautical</td>
<td>1200-1500</td>
<td>954</td>
</tr>
<tr>
<td>Engineering</td>
<td>200-300</td>
<td>288</td>
</tr>
<tr>
<td>Law/Bus/M'ngmnt</td>
<td>1400-1420</td>
<td>381</td>
</tr>
<tr>
<td>Proj/Electives</td>
<td>200-200</td>
<td>158</td>
</tr>
<tr>
<td>Others</td>
<td>nil</td>
<td>314</td>
</tr>
<tr>
<td><strong>Total Hours:</strong></td>
<td><strong>3600-4080</strong></td>
<td><strong>2729</strong></td>
</tr>
</tbody>
</table>

Figure 6.5 shows the percentage distribution of subject groups in the three-year shore-based studies leading to the diploma level. Figure 6.6 shows the percentage distribution of subject groups in the shore-based diploma and advanced diploma studies.
Proposed Monovalent (Dk. Officers) Scheme

Figure 6.5 - Percentage Distribution of Subject Groups in the Three-Year Shore-Based Diploma Studies of the Proposed Scheme

- L/B/M (24.0%)
- Naut (38.0%)
- Mar.Eng (9.0%)
- Pr/El (7.0%)
- Support (22.0%)
Figure 6.6 - Percentage Distribution of Subject Groups in the Shore-Based Diploma and Advanced Diploma Studies of the Proposed Scheme

- Proposed Monovalent (Diploma + Advanced Diploma) Scheme
- Support (16.0%)
- Pr/El (5.0%)
- Naut (35.0%)
- L/B/M (37.0%)
- Mar.Eng (7.0%)
The following list describes the possible subjects under each group. The names should be taken as indicative of subject areas rather than proper names:

Support Group
1. English (maritime/technical)  
2. Mathematics  
3. Statistics  
4. Physics/electronics  
5. Chemistry  
6. Computer Studies

Nautical Group
1. Navigation- ocean and coastal  
2. Electronic Navigation Systems  
3. Seamanship- theory and practice  
4. Marine Safety  
5. Shipboard Operation  
6. Collision Regulations  
7. Meteorology and Oceanography  
8. Instruments  
9. Work Simulations  
10. Communication Systems  
11. Stability  
12. All STCW mandatory courses

Engineering Group  
1. Technical Drawings  
2. Engineering Mechanics  
3. Thermodynamics  
4. Electrotechnology  
5. Marine automation  
6. Instrumentations  
7. Heat Transfer  
8. Marine Systems  
9. Naval Architecture  
10. Marine Power Plants  
11. Work simulation  
12. Workshop Practice
Law/Business/Management Group

1. Transport Economics
2. Integrated Transport Practice and Management
3. International Maritime Law
4. Marine Insurance
5. Ship Chartering and Brokerage
6. Ship’s Master Business
7. International Trade and Shipping
8. Principles of Accounting

Project/Electives Group

1. A written project on a maritime topic of 10,000-15,000 words.
2. Electives - options on subjects covering students professional interests.

6.3 Concluding remarks

The above guidelines for the two proposed schemes attempt to create a flexible educational and training system and to satisfy the needs of various groups not only for now but also into the future. In the process, the needs of various groups are inevitably compromised and as such the scheme may fall short of the expectations of some groups. Designing a perfect scheme is of course impossible. National consensus is therefore required.

The national requirement for national service of two and one-half years is not taken into consideration. It has an effect of increasing the length of the whole scheme but does not substantially alter the concept herein proposed. Other effects on the overall system brought about by the two and one-half year interruption
are acknowledged but are not a subject of discussion in this project.

The content hours is derived based on the experiences of other countries' MET systems as analysed in Chapter Five. Critics of this project may be quick to point out that those countries start off with high school graduates and the hours for the different subject groups cannot be directly applied to Singapore whose entrants to the MET scheme are secondary school leavers. The writer acknowledges this difference but believes that the hours provided a reasonable basis in which to distribute the time available for the various subject groups. The hours can be modified as necessary. It is acknowledged that a higher entry requirements can shorten the length of shore-based studies. However, Singapore MET awards a diploma and not a degree and therefore the entry level is appropriate. Furthermore, the writer believes that the higher academic qualifications required in those countries are more for the purpose of ensuring that the students can follow the academic side of the curriculum leading to the award of a degree the standard of which are nationally established rather than for the professional side of the curriculum. Whatever the case, the schemes proposed by the writer includes an extra one year of shore-based studies at the advanced diploma level giving a total of four years of shore-based studies which is more than the period allowed for in the schemes of the USA, Netherlands, and Australia and of equal duration to the dual-purpose schemes of France and the FRG. Table 6.1 and Table 6.2 show that the teaching hours allocated for each subject group in the proposed schemes of Singapore is in most cases much higher than the averaged of all the other countries taken together. What is lacking in the proposed scheme is perhaps the absence of practical shipboard service
in the first period of shore-based studies.

No attempt is made to provide detail syllabuses as this will require collective works mainly by the academic staff of the teaching institution. This is only possible after majority agreement on the overall concept is obtained. Details of the shipboard training programme is also not covered. Furthermore, to include comprehensive syllabuses for the two proposed schemes will be voluminous for the purpose of this project.
CHAPTER SEVEN

RECOMMENDATIONS

Comparative studies of various MET systems in Chapter Five focus on the structure and distribution of curriculum by time. From this comparative studies, conceptual outlines of two proposals relating to a new MET scheme for Singapore are recommended in Chapter Six. It is obviously impossible in this project to cover all issues surrounding the implementation of a new MET system and to write in detail on many of them.

In this chapter some of the issues surrounding MET are briefly covered as a list of recommendations.

7.1 Recommendations

7.1.1 Rationalising the use of scarce resources

The problem of financing MET is more acute in comparison to education and training for the other industries because of the low number of students and the need of expensive equipment such as simulators if effective training is to be carried out. It is recommended that the Nautical Studies and the Marine Engineering departments in the Singapore Polytechnic (SP) be amalgamated to form a new maritime department and a new name carefully chosen so as to reflect its combine and extended activity. This will enable resources to be more fruitfully utilised and at
the same time cost minimised by taking advantage of the economy of scale. Being a larger department will also strengthened the position of the department vis-a-vis the other departments in competing for votes and resources. Arising from a feeling of a single department is a common goal, and expertise of both the deck and engine disciplines can be better utilised to achieve this goal. The purpose is more true if integrated training is to be adopted.

7.1.2 "Apprenticeship Tax" scheme

As shortage of funds will always be a problem for MET, a method of obtaining such funds should be devised. An "Apprenticeship Tax" scheme could provide one solution. Under the scheme, all shipowners whether they are involved in training or not are mandatorily required to contribute to the fund which is tax deductible. The amount of contribution is proportional to their fleet size. This scheme is fairer than the cadet sponsorship scheme as it prevents any shipowner who do not sponsor cadets from "pinching" officers whose training had been paid for by other shipowners. As the main cost of MET should be subsidized through the normal national education vote, this fund is used mainly for the financing of expensive equipment such as navigation, engine and liquid cargo handling simulators. The money is paid directly to the Treasury and is made available to the training institution upon request through the normal governmental administrative procedures. The provision will require national legislation before it can be successfully implemented.
7.1.3 A national approach towards education and training for the maritime industry

On a national scale, there should be greater cooperation among institutions or bodies involved in education and training for the maritime industry as a whole.

The National Maritime Board (NMB) which conducts watchkeeping engineer and rating training and the maritime departments of the Singapore Polytechnic will need to work closer together in training shipboard personnel especially if reduced manning aboard Singapore registered vessels is envisaged. For example, if dual-purpose officer training is adopted by the Singapore polytechnic, the NMB will need to complement this with a general-purpose rating training.

Similarly, if the proposed scheme(s) in Chapter Six is adopted then there will be a need to have a rational look at the watchkeeping engineer training conducted by the NMB and to see where it fits into the whole scheme and to avoid unnecessary duplication.

The Port of Singapore Authority (PSA) training department is also involved in training for the maritime industry in the area of port management and administration, port safety, warehousing, forwarding and pilot and VTS operator training. PSA is planning to buy a ship-handling simulator for its pilot and VTS operator training and probably for research and development work. Obviously there is a common ground in the training needs of PSA and the maritime departments of the Singapore Polytechnic especially in the field of ship-handling simulators in which cooperation and conservation of resources is possible. Respective authorities in charge of the SP and PSA
should make a study on the possibility of a joint capital funding for the simulator. In addition, it should also be possible for the Nautical Studies Department of the SP who have had many years experience in simulator training to provide qualified simulator instructors in addition to those that are presumably to be sent for training by the PSA.

Expansion of the MET at the SP into areas of port and transport management and administration studies is a logical step as adopted by MET institutions in United Kingdom as an example. In future there could be competition with the courses being planned or run by the PSA with those run by the maritime departments of the Singapore Polytechnic. It appears that it would be better if there is a national approach to training for the maritime industry.

7.1.4 Providing education and training for the Singapore navy

Two immediate and important tasks of the new MET is: to provide education and training which promotes employment opportunities for its graduates that is not restricted (by tradition) to commercial shipping and to "sell" its expertise that it is capable of serving the education and training needs of other types of employers with the view of increasing the number of students in each course. It is proposed that the new MET should look seriously at the possibilities of increasing its education and training services which it presently offer to the Singapore Navy. In previous years, the joint Singapore Armed Forces and SP Diploma in Marine Engineering scheme has provided the much needed increase in student numbers for the Department of Marine Engineering. The part time courses for the
Singapore Navy radar operators and midshipmen which are run by the Department of Nautical Studies on its simulator has to some extent contributed financially towards the operational running cost of the simulator. Should such co-operation ends here? Educational and training links between maritime institutions and the navy is not uncommon as found for example in the USA and France. About 20% to 30% of new intakes into MET are either recruited through the navy or a similar percentage of the MET graduates are eventually recruited into the navy as trainee engineers and midshipmen. The navy therefore can be viewed as both an important source of students for MET courses and an employer for its graduates and for this purpose all further avenues of providing education and training for the Singapore Navy must be explored.

7.1.5 Simulators for training

The proposed MET scheme(s) will take three years of continuous studies at the SP. The disadvantage as discussed in Chapter Six is in the absence of sea experience which is sacrificed for the purpose of fitting into the SP norm. It will become more imperative that some areas of learning need to be more effectively covered in the shore-based studies. The use of training simulators is now a common feature in many MET institutions.

In the SP, training on simulators have been carried out for many years. There is a radar/ARPA simulator in the Nautical Studies Department which is about six years old and an engine simulator in the Marine Engineering Department which is about five years old. It should be relatively cheaper to replace parts and add visuals to the existing radar/ARPA simulator.
than buying a new ship-handling simulator. Training on the simulator even with the addition of visuals will never fully replace the importance of sea experience. However, it will greatly improve work simulation in the classroom by bringing it much closer to the reality. This is necessary to make-up for the absence of sea-service in the initial stage of the students education and training at the SP.

A few years ago the installation of a liquid cargo-handling simulator for training in the handling of hazardous liquid cargoes was shelved because of the recession in shipping. It is recommended that the decision be reconsidered in the light of the proposed MET scheme(s). In addition, a satcom simulator (which is not expensive) for communication training should also be installed.

7.1.6 Recognition for the academic qualification of the new MET diploma

It has been identified in Chapter Six that the new MET should also provide an education and training for both the sea and shore industries and that it promotes opportunities for the graduates if they wish to continue their studies. Towards these ends, it is not only essential that the academic qualification of the new MET be widely promoted to employers but it is also recognised by reputable universities and professional/diploma bodies. To achieve this, links with professional/diploma bodies and universities should be established. The best way is to invite consultancies from these universities and professional/diploma bodies to review the MET curriculum and for them to provide inputs on its improvement. The existing Diploma in Nautical Studies
for example has managed to obtain some remission of subjects from the Chartered Institute of Transport examination. The new proposed diploma should aim for greater remissions from the examinations of professional bodies such as the Institute of Chartered Shipbrokers and the Institute of Marine Insurance as examples. At present, some in-roads have also been made with the Institute of Chartered Shipbrokers and this link must be forged further under the new scheme. Recognition of the academic diploma by reputable universities should also provide the MET graduates with easier access into these universities. There should also be possibilities for them to obtain remission or credit transfer which in some cases will be sufficient to allow them to join directly into the second year of the universities' degree courses as achieved by the diploma graduates of other courses in the SP.

7.1.7 Reduction in shipboard manning project

Some form of "A Reduction in Shipboard Manning Project" should be undertaken by a leading Singapore shipping company or by the shipowners collectively in collaboration with the maritime administration and MET institutions. Such studies by the shipowners is very useful in helping to arrive at the decision to implement reduce manning practices aboard Singapore ships. It will also help in clearing any doubts on the viability of such manning aboard existing ships with the use of dual-purpose officers.

7.1.8 Staff qualifications

MET should serve the education and training of the maritime industry as a whole. Maritime teachers and
Lecturers today need more than just professional Master or Chief Engineer qualifications. Additional advanced qualification of the staff is required if MET is to move beyond the teaching of ship officers. A scheme whereby staff are allowed to improve themselves is already in existence in the Singapore Polytechnic. This scheme should be more strongly promoted for the staff of the two maritime departments.

The expanded scope of MET will require MET teachers with Master and Chief Engineer qualifications to upgrade themselves in areas which are traditionally not their strong points. Otherwise, it may become necessary to recruit teachers that are qualified in computing, business, transport, mathematics, science and law into the department.

7.1.9 Co-operation with neighbouring country institutions

MET for any country is expensive and in many cases development is hampered by the shortage of funds. Regional co-operation may solve some of the problems. As a starting point, a closer link can be forged with Malaysian Maritime Academy (ALAM). Perhaps each institution should concentrate on the development of one area of expertise. As an example, SP would concentrate on Ship-Simulator Training and ALAM on Liquid Cargo-Handling Simulator Training. An acceptable arrangement should be possible where students from each country can be train on both simulators. There is nothing new in such co-operation as ALAM used to send their students for training on the SP radar/ARPA simulator.
7.1.10 Harmonization of MET with neighbouring countries

Shipping is a global industry and attempts to harmonize standards of training led to the adoption of the STCW Convention. In a more localised context, harmonization of seagoing career and certificate of competency with neighbouring Malaysia should be promoted. Both Singapore and Malaysia inherited the UK system of examination and certification and therefore a lot of common grounds already exist. Unfortunately, these common grounds are slowly eroded over the years as each country attempts to develop its own unique MET and examination and certification systems. With the pace of change accelerating, the differences will widen until we could no longer accept each other qualifications unless something is done about it. Harmonization of sea-faring careers and examination and certification should be promoted. Both Singapore and Malaysia should jointly get away from the UK system and develop more or less similar pattern of MET and Certification structure. As the world today is moving towards regionalism, the concept of harmonization in MET can in the future be extended to other ASEAN countries.
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xvi