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# Maritime education and training (engineering) in the modern technological age

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# MARITIME EDUCATION AND TRAINING (ENGINEERING) IN THE MODERN TECHNOLOGICAL AGE: AN APPRAISAL OF THE MALAYSIAN SYSTEM.

by

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

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Lau Seng Chuan

## ABSTRACT

The world in general is in a time of accelerating change. Modern technology, in particular, electronics have tremendous impact on the Maritime industry.

This paper looks at the extent of application of modern technology on board ships. The possible impact on the future operations and manning of ships is also assessed. How the developed world has tried to harness established and newly developed technology for the benefit of its new ships is discussed. The extent to which maritime education and training institutions in these countries and Malaysia have adapted to these changes is the central focus of this paper.

The paper then discusses how Malaysia should go forth in meeting this challenge by evolving a more coherent, adaptable and positive MET* (Engineering) system. Specific recommendations which can be easily implemented and which are believed will have effective results are made.

## LIST OF ABBREVIATIONS

| | |
|---|---|
| ALAM | Malaysian Maritime Academy |
| C.O.C | Certificate of competency |
| D.O.Tp | Department of Transport, UK |
| EEZ | Exclusive economic zone |
| FRG | Federal Republic of Germany |
| GRT | Gross registered tons |
| IKMAL | Malaysian Maritime Institute |
| IMO | International Maritime Organisation |
| KW | Kilowatts |
| MARPOL | International convention for the prevention of pollution from ships, 73/78 |
| MEO | Marine engineer officer |
| MET | Maritime education and training |
| MISC | Malaysian International Shipping Corporation |
| MSS | Months of sea service |
| OECD | Organisation for Economic Cooperation and Development |
| PNSL | National shipping corporation limited (Malaysia) |
| PUO | Polytechnic Ungku Omar |
| SMU | Szczecin Maritime University |
| SOLAS | International convention for the safety of life at sea, 74/78 |
| STCW | International convention on standards of training, certification and watchkeeping 1978 |
| T&M | Technology and Manning Report, UK |
| UK | United Kingdom |
| UMS | Unmanned machinery spaces |
| UNCLOS | United Nations Convention on Law of the Sea |
| USA | United States of America |
| USCG | United States Coast Guard |
| USMMA | United States Merchant Marine Academy |
| UTM | Malaysian Technology University |

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CHAPTER 1

# THE INTERNATIONAL ENVIRONMENT: IMPETUS FOR CHANGE.

## 1.1 A world of accelerating change

Never since the Industrial Revolution has there been greater change than the few decades since the invention of the transistor in 1949 by Shockley, Brittain and Bardeen. Its impact is unparalleled and destined to change the operation of many industries.

Integrated circuits incorporating these transistors appeared very quickly after their invention. Miniaturisation of these circuits was found to be beneficial and microelectronics gained importance. The race to put more and more transistors on a single chip of silicon is now being fought and the search for the ultimate chip has not abated.

Based on the cheap raw material of silica, these microchips have become very cheap over the years(Stevens,30). These chips have made their way into the heart of many industrial and domestic applications. The power of the chip cuts across all industrial, medical, agricultural, communications and other sectors. The ubiquitous home computer, for instance, has not only become more powerful in terms of data processing rate but has actually become cheaper. Complex operations of all sorts, which would have taken many man-hours, have become possible within seconds.

### 1.2 Modern technology in ships

The use of chip power is extremely encompassing and the maritime sector is no exception to its invasion. Since the mid-sixties when the bold step was first taken to move the ship engineer away from the gathering of information by sight, sound and smell, the automation of marine machinery has flourished(Wilber,36.).

Since then, there has been no turning back. In fact, application in the maritime field was boosted as a result of the oil crisis in the seventies. The worldwide recession that followed shook the world shipping community. Depressed freight rates were not enough to sustain shipping companies. Many, including some of the big ones, disappeared. Survivability become paramount and many owners and operators looked towards modern technology as a possible saviour.

The developed maritime countries initiated many projects to employ modern technology as a means to more efficient and economical ships. Technology was used as a tool to optimise operational costs by reducing manning costs.

This path was also forced upon the developed countries when many developing countries decided to start their own shipping fleets in the last few decades. With the comparative advantage in cheaper labour costs, many of these developed countries found that they could not compete without, amongst other things, crew reduction. They turned strongly towards modern technology to provide the means to regain economic competitiveness.

### 1.3 Crew and manning trends

Many studies have been initiated by the developed countries on modern manning systems. Japan commenced its own studies as early as 1963 (Wada,33). Under the Japanese method, the crew reduction was carried out in stages over years. At the present advanced stage it has been shown that a 14-man crew on the selected experimental ships has been successful. They are well on the way of achieving the target of a ship manned by 11 men.

The Netherlands, Sweden, Norway, United Kingdom (Uk) and Federal Republic of Germany (FRG), to name a few, have their own programmes in this same direction. It seems fairly safe to say that the days of the 30-man crew for a comparable size ship is over.

### 1.4 Maritime Education and Training worldwide

The advent of new technological and manning systems necessitate a review and updating of the curriculum of maritime colleges worldwide. After all, these institutions supply the required personnel to operate, maintain and run these ships.

The institutions of most developed maritime nations have shown remarkable flexibility and adaptability to face the new challenges. Various studies have been conducted centering on the projected new technology, ship types, skills analysis, tasks analysis, assessment methods and other related areas. The United Kingdom has conducted a Technology and Manning study ( D.O.Tp,3) that concluded that significant changes have to be made to the Education and Training of seafarers of the future.

Some countries, notably the Netherlands and France, have gone ahead with completely new curriculums for their seagoing officers. More details of the response of maritime administrations of various countries are given in Chapter 3.

## 1.5 Malaysia: A player in the maritime world.

Malaysia trades freely and openly with every country of the world. A naturally endowed country, it has shown remarkable economic growth despite the worldwide recession and commodities downturn in the eighties. A strong leadership and stable government has ensured uninterrupted growth in all sectors since independence in 1957.

Maritime activities, including shipbuilding, owning and management, has expanded rapidly over the years. With a deadweight tonnage of over 2.2 million tons (appendix 2) in 1988 we have a large foreign-going and domestic tonnage. The well diversified fleet of containers, bulk carriers, LNG carriers, general cargo, passenger ships and tankers cater to the transport demands of the country. The two major shipping companies, namely the Malaysian International Shipping Corporation (MISC) and the National Shipping Corporation Lines (PNSL), together own over 50 foreign going ships.

With a vast interest in maritime industry, Malaysia watches the international world of changes closely. We could not afford to be an isolationist country. We should continue to take note of the mounting external changes and development.

The competitiveness of overseas fleets affects our performances in the world market. International freight rates affect our competitiveness and hence our own profitability. The management of our major shipping companies have to be accountable to their shareholders. We shall continue to learn from the outside world, systems and ideas that can adapt our shipping industry in the face of a world of tremendous and rapid changes. To ignore the realities is to suffer irrecoverable lag in our chances for greater growth and prosperity.

# CHAPTER 2: MODERN TECHNOLOGY

## 2.1 WHAT MODERN TECHNOLOGY ?

"The most rapid development which has influenced engineering design and operation of ships has been in the electronics industry." That opening statement by a session chairman during a Motor Ship seminar underlines the most startling and pervasive development of all times. Electronics and microelectronics have pervaded all sectors of the maritime industry. The microchip and the microprocessor have allowed the control and operation of many processes to undergo many incremental improvements over the years. It should however be remembered that other conventional areas of ship design and operation have also been affected.

Today a substantial enhancement in the marine engineering scene has been witnessed. All aspects of maritime operations have been influenced and a new picture has now emerged.

Not only are modern ships operated more efficiently and effectively, but technology has been harnessed to its utmost. Developed countries possessing the know-how and financial capability have lead the search for new ways and means to even better the presently enviable standards achieved. Japan has conducted "ship of the future" projects since the sixties. Sweden and West Germany have programmes in varying forms and names. All share the same objectives of using modern technological advances to optimise ship operation and competitiveness.

A survey of the main areas of technological developments is timely at the moment. The main areas are given below.

### 2.1.1 PROPULSIVE SYSTEMS

The diesel engine is reckoned to be the undisputed prime mover in the marine propulsion arena (Harrold,11: Engja,5). Steam turbines and gas turbines, although enjoying specialised applications, have not been able to upset the dominance of the diesel engine.

The slow speed diesel engine seems to have the lead when compared to its medium speed counterparts. Hard economic competition has effectively rationalised the slow speed diesel engine market. Two major makers now dominate this market. Sulzer and MAN-B&W appear to have the monopoly of this area with more than ninety percent of the market between them (Motorship,20).

The medium speed diesel engine makers which claim an increasing share of the propulsion power market ares more numerous. Sulzer and MAN-B&W also have a significant share of this market. Other makers include Pielstick, Wartsila, Daihatsu and MaK and others are very active in this market.

Diesel engines have generally become more reliable, maintenance friendly and economical. Maintenance intervals between overhauls have increased significantly to about ten thousand hours. Fuel consumption has improved by nearly thirty percent to a claimed figure of about 120 grams per bhp-hour. Larger stroke-bore ratios and higher peak and maximum pressures have contributed to this improvement. The combustion capability has also been enhanced. Difficult and obnoxious fuels combustion technology has become highly developed.

It is envisaged that continuous research and development will continue but it is not anticipated that revolutionary improvements in fuel economy will be achieved. More emphasis will be placed on reliability studies of these engines. This will enable the concept of reduced manning to be placed on a stronger platform.

### 2.1.2 REMOTE CONTROL SYSTEMS FOR MAIN PROPULSION

Remote control systems for main propulsion are a prerequisite for UMS Ship operation. These systems have been developed to a very advanced level. A typical modern system is comprised of an advanced microcomputer system offering very special features. The basic function of starting, stopping, reversing, run-up and run-down of the engines can be attained finely and accurately by selecting the appropriate programmes. Maximum manoeuvrability, low fuel and start air consumptions are among some of the advantages claimed for these systems.

### 2.1.3 AUXILIARY SYSTEMS

The demands of economical operation have a subtle influence in this area. The more economical generation of electrical power using sophisticated arrangements of shaft generators is an obvious example. Sophisticated waste heat recovery systems, dual fuel generators, blended fuel operations and lately single fuel ships made their presence known in quick succession.

The worldwide adoption of international conventions led to modified shipboard operations. For instance the Marpol convention led to development of more advanced oily water separation technology. Strict control of effluent quality caused more sophisticated control, monitoring and recording equipment to be fitted. SOLAS 73/78 as another example has wide ranging influence in the design and construction of many shipboard applications. For instance Regulations 29 and 30 of chapter II-1 deals with highly different steering systems to meet the more stringent requirements.

In general, reliability and maintainability of auxiliary systems are paramount. This is an area where microprocessor based surveillance systems have made their impact. This area still represents a major workload for operators and therefore continues to be an area to be focused on (Engja,5).

### 2.1.4 MONITORING OF POWER PLANT

This is one area of shipboard operation where microelectronics has the most impact. Automatic data collection, processing, interpretation and transmission are now very common. Larger and larger data volumes and rates have become so established that such systems are now increasingly accurate, responsive and, most importantly, relatively cheap. Human intervention is reducing as more reliable systems evolve. The rate at which these systems are introduced is staggering. A look at the technical journals and periodicals is enough to convince any sceptical reader that this is an area of intense activity. Also, major companies (eg. Siemens, Asea, NorControl, Haven etc.) have many research projects going on in this sector. Condition Monitoring, trend analysis and diagnostics are the higher levels that makers of these systems aim for.

A typical new generation monitoring system designed for use on UMS vessels can normally accept binary or analogue signals in as many as 500 channels. Alarm systems are very easily constructed on a modular basis. All set limits for alarms are capable of being changed at will. Printout for alarms and faulty functions are easily arranged. Manoeuvring signals are automatically logged freeing the engineer from this routine task. The system can normally be accessed from multiple terminals.

Internal system monitoring is usually incorporated. This continuous self monitoring allows the rapid pinpointing of any disturbance that may occur. This allows the watchkeeper to be aware and correct any monitoring malfunction that compromises the integrity of the whole system (Siemens,28).

A sophisticated system is only as good as its sensors. Sensors are regarded by many as the Achilles heel of present systems. According to a survey of United Kingdom shipowners, many of them felt that present sensors "are not up to the mark"(D.O.Tp, 3 ). The reliability and accuracy of sensors are of utmost importance. Besides having to operate in an adverse marine environment, they have to be robust and rugged. This is especially so for combustion chamber sensors which have to withstand extreme temperatures and pressures.

Other areas, including that of electromagnetic compatibility and interference, have a direct influence on the minute control signals of these modern monitoring systems. Performance and condition monitoring will be applied increasingly, subject to the development of more reliable and inexpensive systems.

Research and development in this sector will continue strongly. Systems will have enhanced reliability with the goal of reducing manning further.

### 2.1.5 NAVIGATION

Although automation and control first commenced strongly in the engine room, the navigation functions have also changed with the invasion of modern technology. New integrated systems have been introduced which have clearly altered the conventional bridge design and layout. Optimum bridge design and instrumentation have been the subject of many studies over the years. The objective has been to reduce the strain and workload of the watchkeeping officer. This could be achieved by improved ergonomics of bridge equipment. By careful design the officer is assisted to arrive at the right decision and to take the correct action as demanded by the circumstances. The collection of information and data has been simplified and centralised so that most data that a bridge operator may require is available at the touch of a keyboard button.

A typical system features , for instance, a multisensor positioning system. Here the system automatically selects the optimum navigation system relative to the vessel's position in any part of the world (Lloyds, 18).

"Live situation report" is another feature that is available at the press of a keyboard button. "Full-away" data, manoeuvring parameters or voyage plan particulars will completely release the navigator from the routine tasks associated with the collection of information such as ship's speed, engine rpm, rudder angle, next waypoint etc.

Graphical representaion of the important parameters and colour screens are some features where more powerful computers have made their impact.

Electronic seacharts and Global Positioning Systems (GPS) are being developed to enable the one-man navigator easy and immediate information. The basic philosophy is to combine the electronic seachart with radar and ship management data into a central information point on the bridge. Thereafter the one-man bridge operation will be approached on most ships (White, 35).

As the ship operation centre concept takes hold, bridge layout will address the interface of the engineering functions console and also the communications functions console. Then the truly one-man watchkeeping for the entire ship will be achieved.

### 2.1.6 COMMUNICATIONS

A tremendous growth in maritime communications has been achieved. A network of orbiting satellites has now made ship-shore communications a matter of pushing the correct buttons.

With the implementation of GMDSS, a worldwide regime of reliable and efficient distress management system will be in place. Maritime search and rescue efforts and maritime safety will be enhanced considerably.

Ship-shore reporting systems have also been developed which allows automatic data transmission from onboard computers to shore management offices. This will allow greater monitoring of the entire ship operations with possibly greater productivity.

## 2.2 PROJECTS BY THE DEVELOPED COUNTRIES

Various developed maritime countries have commenced various study projects since the sixties. Although known by different names, they share the same basic objectives: to study the technology required to reduce operational costs of the ship and thereby regain the economic competitiveness in the market.

The research and development programmes arrive at a number of common conclusions. They are listed below.

1. The bridge is the ship operations centre (SOC) of the future ship. Alarm monitoring and control of the system processes are performed from the bridge.

2. The degree of automation will be high.

3. Safety and efficiency aspects of system and ship operations are maintained.

4. The number of crew will be small. The designed number of crew will be about ten to twelve.

### 2.2.1 THE CHANGED ROLE OF THE SHIP OPERATOR

Technological advances have allowed centralisation of the ship's monitoring and control system. In this aspect, the ship operation centre is the place where the ship officer's main tasks will be performed. These will include functions of navigation, propulsion control, communications, cargowork monitoring and conditioning and also administration and documentation.

The role of the ship officer is expected to be changed. He should now have the multiskills of the navigator, engineer, radio officer, computer operator and manager (Jaspers, 17 ).

His tasks, according to Jaspers, consists of:

i. supervision of automatic and self-regulating processes.

ii. optimisation of ship operation.

iii. preventive maintenance as diagnosed by the condition monitoring systems.

iv. fault management

v. administration and documentation.

He is aided in arriving at the correct decision and taking the most appropriate action by proper design of the work station and instrumentation.

These projects recognise that the human element must not be overlooked. His education and training must now require attention and scrutiny. Major changes in the curriculum should focus on modern control engineering, electronics, microprocessors, computers and information technology (Jaspers, 17 ).

Additionally he is likely to read subjects like navigation, engineering, communications and management amongst others. His training for such hi-tech ships is likely to be polyvalent. The Netherlands and France are two of the countries that seemed to believe so and have acted accordingly. Their systems of training are described in Chapter 3.

## 2.3 MODERN TECHNOLOGY- THE FUTURE

It is unlikely that implementation of modern technology will stop. The drive for enhanced optimisation of ship operation and safety will ensure continuous research and development.

Many 'ship of the future' projects have run their term. New studies were initiated to further explore possibilities uncovered during the initial projects. West Germany, for instance, has continued with an advanced project upon the completion of the original project.

The present advanced technology is certain to be very common in the future. Already many ships have been built incorporating many features of the 'ship of the future' project. The 'Samantha' class ships and the American President Lines C-10 containerships are just a couple of examples.

The emphasis in future will be towards artificial intelligence, knowledge engineering and information technology. These are activities that require the professional manipulation and processing of information as well as the use of computers, software and information systems. Japan, for instance, will continue to exploit knowledge-intensive industries to maintain its position as one of the the leading maritime nation of the world. So, knowledge based systems including expert systems are likely to gain increased prominence in the future. Engja (5) believes that the future trend will be connected to the development of microprocessor-based intelligence instruments dedicated to the recording of information relating to one or few areas. These data are then sent on-line to expert systems residing in personal computers. Their incorporation may be taken depending on a cost-effectiveness analysis involving social, economic, and political factors.

Ships, however, are unlikely to get less automated and the hard reality is that ships are likely to incorporate more and more modern technology. The question remains:

**Are we ready to make our MET graduates ready ?**

# CHAPTER 3 Maritime education and training: The international situation.

## 3.1 General

The responses to the rapidly changed maritime environment by many different countries around the world are indeed various. In the earlier post-independence years, developing countries around the world invariably adopted the system practised by their colonial masters. Over the last decade, many of these countries have developed systems that are quite distinctly their own. Australia is an example. Still many others have happily gone along with the original systems with little modifications.

Malaysia could be considered to be of the latter category. We are at the crossroads of change. Should there now be changes to reflect the more dynamic environment that we are in? Perhaps if the evolutions in the developed world are noted, then we can steer along a well tried and successful path. This is more likely to bring sure benefits as it has done for the developed world.

The developed world, with vast resources, expertise and experience, could give many developing countries beneficial guidelines on the approach. The application of new technology on ships has been relentlessly tried by these countries. MET institutions have evolved new schemes which have been tried and tested, the results of which could provide a lesson in the selection of the path for the developing countries to follow. To be able to do so, a look at the general direction of MET in these countries may be invaluable.

## 3.2 The general trend.

Almost all European countries, the United States of America and Australia have developed systems that incorporate certificate of competency awards into national education systems. Graduates of these systems enjoy nationally recognised qualifications together with a basic watchkeeping certificate of competency complying with the STCW 78.

Such systems of MET have a course structure of academic work and sea experience that covers the minimum requirements of the STCW for the award of a watchkeeping certificate of competency. This front-ended system enables all the theoretical work to be done at the beginning of one's career. It obviates the necessity of very time consuming and expensive leave for officers to upgrade to the next level of certification. Also mature senior engineers do not have to attempt many new subjects at a time when youth vigor is not a strong asset. It is generally found that intensive study at an adult age tends to be difficult. The problem of family related pressures are often non-existent at the younger age.

Such systems of education are also generally in line with that of other professions ashore. The theoretical knowledge is attained first. Then the competency experiences are acquired after graduation to fulfil the requirements of the profession.

Many of these systems are accredited by the professional bodies of the countries concerned. This tends to make the courses much more attractive to potential entrants. It also helps to alleviate the problem of insufficient entrants as many are encouraged by the nationally recognised academic awards.

Entrant qualifications tend to be higher than they had previously been. On average, 12 years of schooling with good grades in science and mathematics seem to be the entrance requirements. This is not surprising as the level of material and compactness of the course demand a better input of students.

Also, in almost all these countries, the examination of the students has been conducted by the institutions themselves. The function of assessing these students has been integrated into the course structure thereby allowing the marine administration to attend to other more pressing matters. In the UK and France, the marine administrations have retained direct control over the safety competency of the graduates by taking the 'orals' part of the examination. The MET institutions are delegated the responsibilities of the written part of the examinations. In other countries notably USA and Netherlands, this orals part has not been a part of the certificate of competency examination system for many years.

The writer is fortunate to be part of a study team that visited many maritime institutions in a few developed countries including the United Kingdom, United States of America, France, Federal Republic of Germany, Poland and the Soviet Union. The current state of MET affairs can be summed as fluid, evolving and changing.

All institutions seem to agree that the world is indeed in an age of vast and rapid change. The rapid advance in technology in the last few decades had been unprecedented in the history of mankind. Many of the institutions are still evolving new courses to better cater to the needs of the industry in their respective countries. The strong cooperation between industry and MET institutions in these countries is manifested in their rapid response to the new demands of technology.

## 3.3 Classification of general trends in the developed world.

Whilst many changes are taking place in MET institutions, it can be seen that the trend seems to be towards two well defined categories. On the one hand, some of the countries are of the view that the traditional interdepartmental disciplines on board ships will be blurred and ultimately removed. France and Netherlands, for example, are moving in this direction and have commenced courses to train bivalent officers.

Others, the more conservative ones , are of the view that ships will continue to be operated along existing lines. Interdepartmental disciplines will continue and this is reflected in the courses that they are offering to their entrants.

## 3.4 MET (ENGINEERING) IN FRANCE

### 3.4.1 GENERAL

France commenced a dual purpose program (Engine and Deck) for their students of the highest and unlimited certificate of competency way back in 1967. Presently France has basically three main courses in training the sea going officers. They are listed below:

i. the first class bivalent certificate of competency (unlimited).

ii. the second class bivalent certificate of competency for ships upto 7500 GRT and 7500 KW propulsion power.

iii. the third class monovalent certificates of competency for coastal trades on ships of up to 1600 GRT and 2250 KW propulsion power.

Whilst the first class bivalent course was started more than twenty years ago amidst tremendous skepticism and doubts, the course nevertheless survived and prospered. In fact it is so successful and the graduates so well received that the second class which was initially monovalent was offered as a bivalent course in 1986. The reasons cited were the easier financial resources and shorter length of time to train the latter group. Apparently being less professionally qualified than the first class group they have less professional mobility. They are expected to become a longer serving and bigger pool of manpower for the shipowners to draw on. The second class officers are expected to be able to serve in the highest capacity (that is as masters or chief engineers) in the majority of French flag vessels as there are few vessels above 7500 GRT and 7500 KW propulsion power.

### 3.4.2 Content of the French curriculum

The basic structure of the two above mentioned courses is shown in flowcharts 1 and 2 below for the first class and second class respectively.

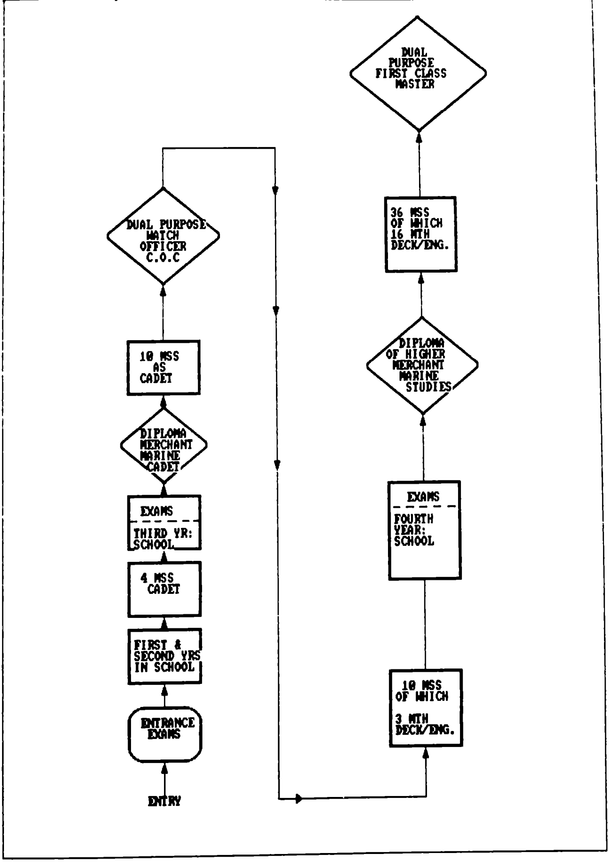
The first class certificate candidate spends a total of 4 years at school and a total effective seatime of 60 months. Of the seatime, 14 months are spent as a marine cadet and the remaining as an officer in both the deck and engine departments.

The second class certificate candidate enters the system at a lower entrance qualification and spends 3 years at school. He too spends a total of 60 months at sea with 24 months as a marine cadet and the remaining 36 months as an officer both on deck and engine departments.

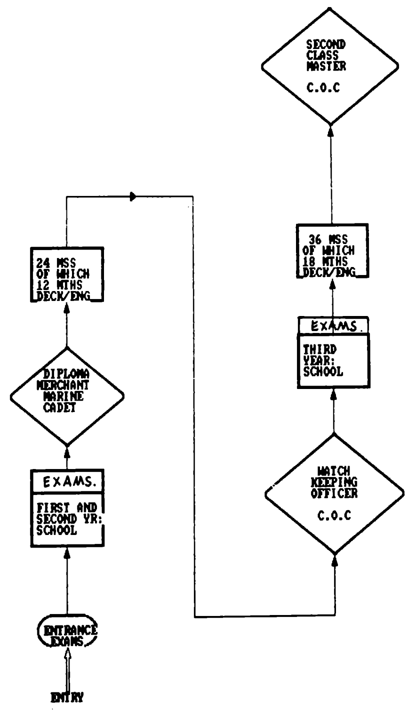
An analysis of the contents and academic years of the first class curriculum reveals the following conclusions. Fundamental subjects studies including the basic sciences do not feature highly in the contents. It can reasonably be assumed that, since candidates are of the baccalaurette (mathematics) level, they should be well equipped with mastery of these fundamental subjects. They are then able to commence with vocational subjects almost immediately. In fact professional and vocational subjects feature significantly from the second year onwards. The students spend a significant 25 percent of their time on various laboratories including electronic data processing, electricity, electronics, thermodynamics, automatic control.

It cannot be denied that the teaching equipment and laboratories are invaluable tools that adequately support the compact load that the curriculum contains. The

FLOWCHART 1 THE FIRST CLASS (BIVALENT) MASTER SYSTEM (FRANCE)



| FLOWCHART 2 | THE SECOND CLASS (BIVALENT) MASTER CERTIFICATION SYSTEM (FRANCE) |
|---|---|



French maritime academies contain the whole range of modern teaching resources with the exception of a training ship. The use of a training ship has been discontinued in France as a means to reduce the expenses of the academies.

It must however be remembered that the social standing of the French ship officer is high in the French society. This surely helps with the recruitment of amply qualified entrants to the profession. They face no problems of lower quality input which some maritime countries have to accept in order that sufficient numbers can be recruited.

However, like many maritime countries, France also suffered from the economic downturn and the changed international situation that caused a substantial reduction in the number of French flag ships. This reduced the demand for ship officers which lead to a rationalisation of the MET institutions. The number of maritime academies was reduced from 4 to 3, with another possible closure. Even the 3 academies at St.Malo, Le Havre and Nantes are operating at a level of utilisation far lower than what they are capable of.

### 3.5 MET (Engineering) in the USA.

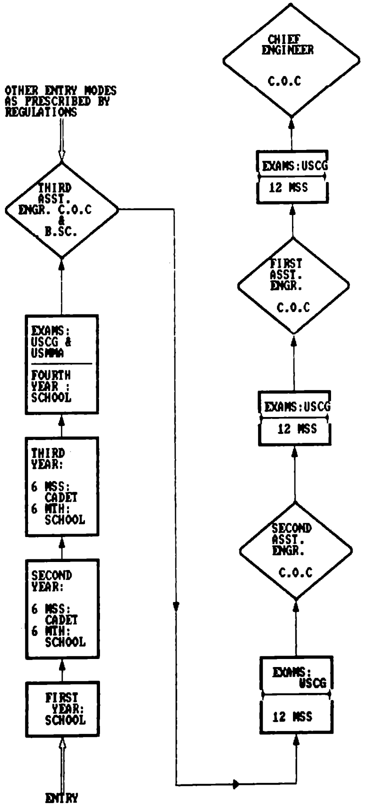
#### 3.5.1 General

The USA has many colleges that have many recognised programs that will enable graduates to proceed as seagoing marine engineers. Even in the colleges themselves, there often exist a choice of monovalent or bivalent type programs. In the example of the United States Merchant Marine Academy (USMMA) at King's Point, N.Y., the Engineering department conducts both a specialised marine engineering as well as a dual license or bivalent program. The latter program is conducted jointly with the Transportation (Navigation) department.

The flowchart 3 overleaf shows the way in which a new entrant can achieve the highest certificate of competency as Chief Engineer by way of a USMMA marine engineering program. It must be stressed that many other degree qualifications are equally accepted. As shown in the flowchart the point of entry into the system is indicated.

The successful entrant is one who has completed high school with good grades in English, Mathematics, Physics or Chemistry. He spends a total of 4 years at school. Within this period, he undertakes a cadet shipboard training of two - 6 month periods (that is a total of one year) on US flag commercial ships. This is to enable him to gain valuable hands-on training and professional on-the -job training. Towards the end of the course, he sits for the academy's final examination and also a license examination conducted by the United States Coast Guard (USCG). Upon successfully passing both examinations, he receives a Bachelor of Science (Marine Engineering) degree, a certificate of competency as a Third Assistant Engineer and a naval reserve officer commission. He can then continue to sail to gain the required seatime and continue to pass the USCG examinations for the next superior certificate. He repeats this process until he achieves the Chief Engineer (unlimited) certificate of competency.

| FLOWCHART 3 | THE UNITED STATES MARINE ENGINEERING LICENSE SYSTEM BY WAY OF THE USMMA MARINE ENGINEERING PROGRAMME. |
|---|---|



### 3.5.2 Contents of the USMMA (Engineering) curriculum.

All students, irrespective of their final major, follow a substantially common curriculum in the first year at school (USMMA catalogue, 1988-89). This common curriculum stresses the fundamental basic sciences, English as well as physical fitness. This emphasis continues into the second year with the introduction of more and more professional and vocational subjects. The study of humanities is featured in the third and fourth years. Management and transportation studies are also featured. Another aspect is the availability of electives where a student selects an option of study. The objective is to allow the student to pursue his professional and intellectual interests in a particular area outside his major specialisation.

This is an example of a course program that gives both the educational and professional aspects a fine balance. It attempts to ensure that students are given a broad general education balanced by sufficient professional specialisation to enable graduates to tackle the job of seagoing marine engineers competently and comfortably.

The supporting educational and training resources include well equipped laboratories, library, machine shops, simulators and also a small training ship. These are planned, organised and integrated effectively to produce a powerful package capable of meeting the objectives of both the shipping community in particular and the community in general.

## 3.6 MET (Engineering) in Poland.

### 3.6.1 General

There are a few maritime institutions preparing students for marine engineering careers. An example is the Szczecin Maritime University. It offers a wide range of courses in the maritime field. They include courses in technical power plant operation, sea fisheries, port operations and sea transport. It also conducts the whole range of courses in marine engineering right up to the First class certificates.

The key marine engineering programme is the 5-year Master of Science course in Power plant operation on board merchant and fishing vessels. It has been reckoned that the power plants on board fishing and merchant vessels are similar. For that reason, only one course is offered.

Aspiring candidates should be less than 23 years of age. They should also have a secondary school education. They must also have passed an entrance examinations comprising mathematics, physics and a foreign language. They should also have a good health certificate. They will also undergo a 2-week sea familiarisation on a training ship to enable them to have a better appreciation of a sea career.

### 3.6.2 Content of the SMU Engineering curriculum

The teaching syllabus is really extensive. The curriculum contains general subjects, social sciences and general technical subjects in the first six semesters.

Another four semesters concentrate on mostly vocational and professional subjects. Thus over a period of ten semesters, the engineering students have to attend to 47 obligatory subjects. Twenty-seven of these subjects include demonstrations to elucidate the theoretical lectures. Twenty-one of these are conducted partly in modern laboratories. It is evident that laboratory and workshop classes are a significant part of the curriculum. Basic engineering craft and skills including machining and welding are also included.

To further fortify these, students have to attend onshore and shipboard training. The shipboard training takes place on board the university's training cargo ship for a period of 22 weeks. The onshore training lasts three months. This is conducted either in the shipyards or the engine workshops.

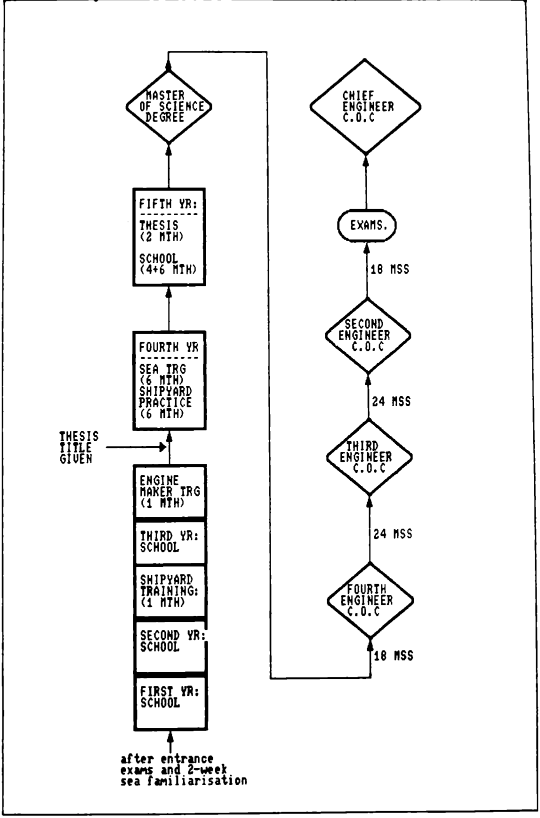
The syllabuses used are worked out after detailed analysis by the teaching staff, seafarers, scientists, experts and others. That means that all syllabuses take into account the latest knowledge of ship technology. The syllabuses also take into consideration the latest international conventions. The teaching faculty uses the latest teaching methods.

Facilities to support the pedagogical functions include the ship's power plant simulator (Dieselsim). Over 50 laboratories serve the whole university. The engineering department uses mainly the electronics, informatics, materials, automation, workshop measurements, fuel testing, refrigeration, air conditioning and other laboratories. The university also has five training ships. Only three are used by the engineering department. They are modified from fishing, general cargo and sailing ships. All have special adaptations to enable teaching to be carried out.

A large library with many titles is also available. It is a very important resource both for teaching and research.

On completion of his studies and after defending his thesis, a graduate obtains his Master of Science degree in Power plant operation on board merchant and fishing vessels. He can then proceed to sea to gain the required seatime for the next class of certificate. The flowchart 4 on the next page shows the stages and the requirements up to the First class engineer level.

FLOWCHART 4 — THE POLISH MARINE ENGINEER CERTIFICATION SYSTEM BY WAY OF THE SMU ENGINEERING PROGRAMME



# CHAPTER 4 MARITIME EDUCATION AND TRAINING : THE PRESENT SCENARIO IN MALAYSIA.

## 4.1 The begining

The year 1969 was significant for the maritime industry in Malaysia. It saw the establishment of the Malaysian national line, namely the Malaysian International Shipping Corporation (MISC). Starting with just one ship in that year, MISC has steadily and quickly developed her fleet in tonnage, number and ship types. In 1988, the Malaysian Flag had over 490 ships totaling over 2.2 million gross registered tons (appendix 2 ). The MISC fleet accounted for over 1.2 million gross registered tons with her 42 ship fleet.

Such a rapid development of the shipping fleet demanded a supply of trained personnel to serve on the ships. In 1972 the Marine Engineering Cadet Programme (Alternative Scheme) was set up in the Polytechnic Ungku Omar (PUO) in Ipoh, Perak under the Colombo Plan. Under this Plan, the Japanese Government provided advisers and equipment to implement the scheme. The Malaysian Government provided the grounds, workshops, local teaching staff, additional equipment and operating budget.

The Inaugural class of students took an unfortunately long time of about 6 years to complete this Diploma course. However since then the course has been reduced to 4 years. Further details of this course are discussed in para 4.2. The courses are now completely handled by Malaysians.

The graduates of this programme usually go on to work on board ships. There they gain the required sea experience to upgrade their professional certificates. This provided a demand for training facilities for these young engineers to pursue such professional upgrading courses.

For many years, many of them went overseas to the United Kingdom, Australia, Singapore and other countries. There they attended courses and were examined for their certificates of competency.

In the light of these demands for upgrading facilities and also to answer the call for a more vigorous maritime sector, the Malaysian Maritime Academy (ALAM) started to offer these courses for the industry. Prior to this development, the Marine Department had commenced to examine candidates for these certificates of competency. Thus the whole MET (Maritime Education and Training) spectrum of providing the basic pre-sea engineering education, sea experience opportunities, and professional upgrading courses and examinations came to be firmly established in Malaysia.

## 4.2 THE PRESENT SYSTEM OF MET

Presently most sea-going marine engineers undergo their training via the alternative cadet training scheme through the PUO. Although the apprenticeship training scheme used to provide the bulk of these personnel for many years, that scheme has now diminished in importance. A description of the various participating MET institutions is given below.

#### 4.2.1 The Polytechnic Ungku Omar (PUO)

**Background**

The Marine Engineering Department is one of several departments in the PUO. The PUO has other departments including the Electrical and Electronic, Mechanical, Commerce and Civil engineering departments. PUO is a higher education institute reporting to the Technical and Vocational Education Division of the Ministry of Education.

As such the budget for development, expansion and other recurrent costs comes from the Ministry. Staffing and conditions of service are subject strictly to government orders.

The polytechnic was chosen way back in 1972 to be the site for the implementation of the alternative training scheme. Although apparently temporary because of want for a better placing, the course has gained some measure of permanence. This entrenchment, in the writer's opinion, is a major obstacle to the more orderly growth and expansion of marine engineering education and training in Malaysia. This will be discussed further in chapter 5.

**The course**

The Marine Engineering Department in PUO currently runs only one course, namely the Diploma in marine engineering course. The present course is a sandwiched 4-year course. The course is divided into 5 phases (I to V) as outlined below:

| PHASE | ACTIVITY | DURATION |
|---|---|---|
| I | First year at UOP | 12 months |
| II | Industrial training/shipyard | 6 months |
| III | Second year at UOP | 9 months |
| IV | Sea training | 12 months |
| V | Final Year at UOP | 9 months |
| | | Total 48 months |

As can be seen from above, the course curriculum is very compact. It is generally found that the student will take more than 4 years to complete the programme. This is taking into consideration the waiting times involved in the placements of students, delays after completion of seatime and other similar problems.

The curriculum in Appendix 3 shows the range of subjects required to adequately prepare the trainee engineer to better perform the job of a sea-going marine engineer.

The output from PUO averages about 40 per year. Due to the relatively high attrition rate of seagoing engineers, the number finally achieving the second class certificate is low. The number achieving the First class is even lower. The number of candidates attending certificates of competency courses is twenty and ten per year for the Second and First class respectively.

### Infrastructure and equipment.

The course significantly emphasized the practical aspects of the profession. Well equipped workshops consisting of most shipboard machinery are also located on campus. These include refrigeration, electrical, deck machinery, steering gear, oil separators, steam boilers, turbines, main engines workshops. Being located in a polytechnic, a wide variety of laboratories are available for use by the students. These include electrical, electronics, materials, thermodynamics, mechanics and other laboratories.

### Teaching staff at the marine engineering department

The Head of department runs the department. He is assisted by a strength of 12 teaching members. Most of them have a bachelor degree qualification. The most common majors are Mechanical and Marine Engineering and Naval Architecture. Only one member of the staff hold a second class certificate of competency as a marine engineer.

However, thus far, there is no member of the staff holding a First class certificate of competency (Marine Engineer). The reason may be that the conditions of service are not conducive enough. The external employment market seems to offer better opportunities and financial rewards.

This is not a desirable situation. An institution producing graduates for the maritime industry that does not have experienced input from that industry is not satisfactory. The theoretical aspects of the course can undoubtably be covered capably. The coverage of the professional and vocational aspects of the course may be, in the writer's opinion, somewhat insufficient.

This aspect of the weakness is not beyond the awareness of the Department. In the past, ALAM, upon request, has always cooperated by sending one of its more experienced staff to assist. There he would attempt to give an intensive week-long course to the final year students. Whether this is an effective way of rectifying the problem, it is by no means certain.

But this cannot be a permanent solution. It is at best only an ad hoc measure. Some permanence must be established. After all an effective education and training programme demands that students understand the interrelationships of the theoretical and professional contents of the curriculum. Constant interaction, review and comtemplation of the material is very necessary.

It encompasses the planning, implementations and conduct of suitable workshops and laboratory programmes that induces the students to think on a more practical basis. After all, no vocational higher education and training can succeed if the trouble-shooting and fault analysis are not strong components of the curriculum. It is highly unlikely that the present arrangements can achieve this.

### 4.2.2 Malaysian Maritime Academy (ALAM)

**Background**

About 300 kilometres due south of the PUO, in the state of Melaka stands ALAM (refer map in Appendix 1). ALAM began as a training centre for ship ratings in 1976. As the national fleet expanded, more manpower, especially of the officers category, was needed. In 1981, the centre was given a charter by the Prime Minister of Malaysia. The centre was upgraded to the status of an academy and hence ALAM was born.

The charter vests ALAM with the authority to conduct courses related to the maritime industry. The charter of the academy is given in Appendix 4. The wide ranging provisions cover, amongst other things, the examinations and research and development in the maritime sector.

The governing body of ALAM is the board of governors. The board is comprised two committees. They are the consultative committee and the selection committee. The principal is the head of the academy. He directs the day to day functioning of the Academy.

There are two departments reporting to the principal. The training department is headed by a director while the administrative department is headed by the registrar.

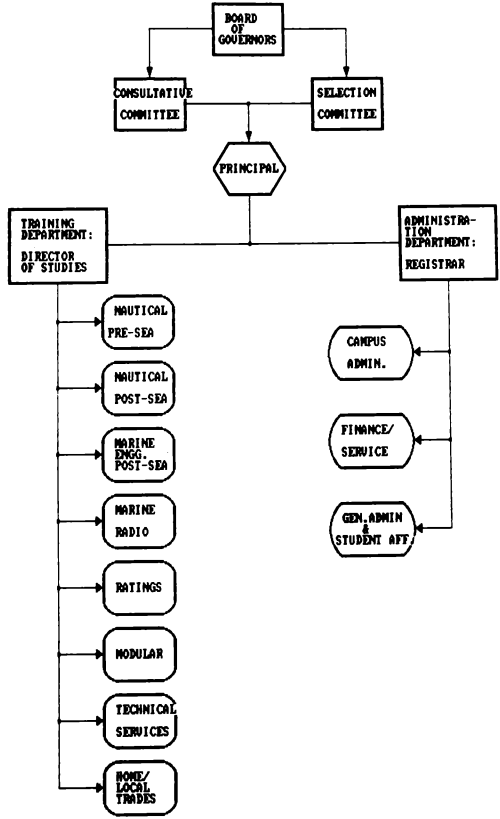
The training department is divided into seven sections. This situation is shown in organisation chart below. The marine engineering section is one of the seven.

**Conduct of marine engineering (post sea) courses.**

In response to the growing demand the academy first conducted the second class Engineers certificate preparatory course in 1983. The first class course commenced the following year. Since then the courses are held regularly three times a year to meet the needs of the industry.

The academy also conducts courses for the marine engine

| ORGANISATION CHART | THE MALAYSIAN MARITIME ACADEMY (ALAM) |
|---|---|



drivers. These marine engine drivers are the unique group of seagoing personnel that forms the bulk of the engine-room personnel that man Malaysia's big coastal fleet. There are three classes of engine drivers, namely the first, second and third class. Engine driver courses of all the three classes are conducted three times per year. The table below shows the courses conducted by the Engineering section of the academy.

| COURSES | DURATION | COURSES PER YEAR |
|---|---|---|
| First cl.Engineers | 14 weeks | 3 |
| Second cl.Engineers | 14 weeks | 3 |
| First cl.Engine drivers | 12 weeks | 3 |
| Second cl.Engine drivers | 8 weeks | 3 |
| Third cl.Engine drivers | 6 weeks | 3 |

**Teaching staff**

The marine engineering section is comprised of five lecturers and one instructor. All, except one, possess the first class certificate of competency (marine engineer). Most of them have trained under the alternative training programme. They therefore additionally hold a diploma in marine engineering.

By means of a more flexible salary and incentive scheme, ALAM staff receive a reasonable financial package. However since a recent BOG (Board of Governors) decision was made to withdraw the incentive scheme, the morale of the staff is likely to wane. Turnover is likely to be a problem in the future as more exciting prospects are likely to exist outside. This is not going to help the existing situation where experienced staff are already in short supply.

Opportunities exist for staff to attend seminars, talks and conferences to upgrade their knowledge. In-service, intensive modular teaching and examinations courses also were conducted. One member of the section ( the writer) was sent to the World Maritime University (WMU) to pursue a Master programme in MET (Engineering). Two members of the section were sent on a 3-month attachment training at a external MET institution. These are very positive and motivating staff development exercises. What is perhaps needed is a more comprehensive programme that the staff members can identify with.

Promotion and career development opportunities are, however, somewhat limited. This aspect is discussed further in para 5.2.

**Equipment and teaching facilities.**

This is one of the areas with the biggest development potential. The present list of equipment is minimal. The academy has, however, the basic machine shop, welding facilities, milling, turning and other machines. All these were originally designed for ratings training.

The engine workshop has some live machinery including a generator set, fuel oil purifier, air compressor and others.

The development budget for more comprehensive workshop facilities has been minimal. No major teaching aid acquisition has been made for some time. This is not a characteristic of a healthy expanding teaching section. This could be due to a perceived notion that the PUO has already the full set of workshop and other training facilities. Duplication must rightly be resisted. This view has created many problems. This is discussed further in para 5.2.

### 4.2.3 Malaysia Technology University (UTM)

Situated approximately 200 kilometres due south of ALAM, is the new campus of UTM. The UTM has just relocated from its campus in Kuala Lumpur.

To meet the demands of the shore based maritime industry, the Mechanical Engineering department of the university was reinforced with a marine technology specialisation. A degree level programme of 5 years duration and a diploma programme of 3 years duration were added. Graduates of these courses will satisfy the needs of the oil and offshore segment, and the shipbuilding and ship repairing industries amongst others. The number of degree and diploma programmes are 15 and 35 per year respectively.

Although very few graduates finally go to sea, their input from the shore side of the industry is very important if a wholesome contribution to maritime safety and environmental protection can be possible.

## 4.3 The proposed system of certification of marine engineer officers for STCW 1978

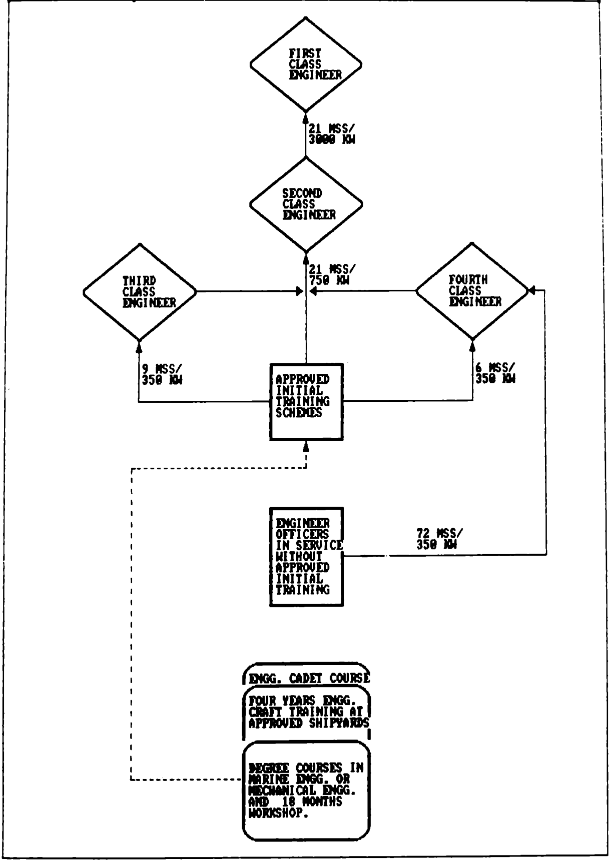
At the time of writing, a piece of legislation concerning the certification of marine engineering personnel is being formed. This will enable Malaysia to accede to the STCW convention. In this paper, the traditional classes of engineers together with the engine driver classes will be discontinued. In its place a single unified system of marine engineering officers (MEO) will be formed. This is expected to simplify the system of certification of marine engineering personnel. The required sea service and entry qualifications are shown in the flowcharts 5, 6 and 7 below (Ghazali, 7).

There are neither any significant changes in the way, or standard, that the examinations are going to be conducted nor any changes to the type of subjects taken at the various classes.

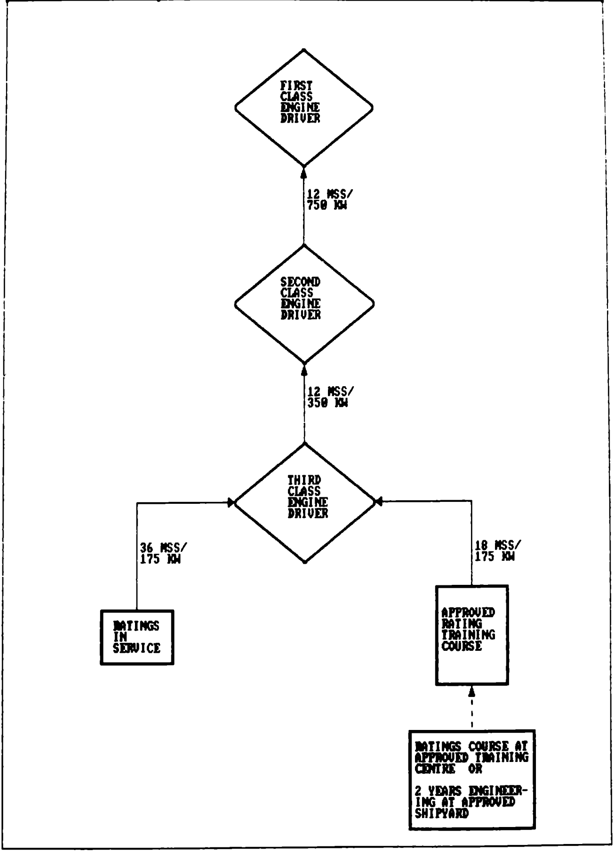
Tables 1 and 2 below shows the limitations of the certificates as per their trading areas and the propulsion power of the vessels.

Although the redesignation of the various levels of marine engineers will take place, there will neither be substantial change in the method of training, nor significant changes in the curriculum. In fact the philosophy for training these personnel will remain basically unchanged even with the introduction of this proposed system.

| FLOWCHART 5 | MALAYSIAN MARINE ENGINEER CERTIFICATION SYSTEM (EXISTING SYSTEM) |
| --- | --- |



| FLOWCHART 6 | MALAYSIAN MARINE ENGINE DRIVER CERTIFICATION SYSTEM (EXISTING) |
|---|---|



| FLOWCHART 7 | PROPOSED MARINE ENGINEER OFFICER (MEO) CERTIFICATION SYSTEM FOR MALAYSIA. |
|---|---|

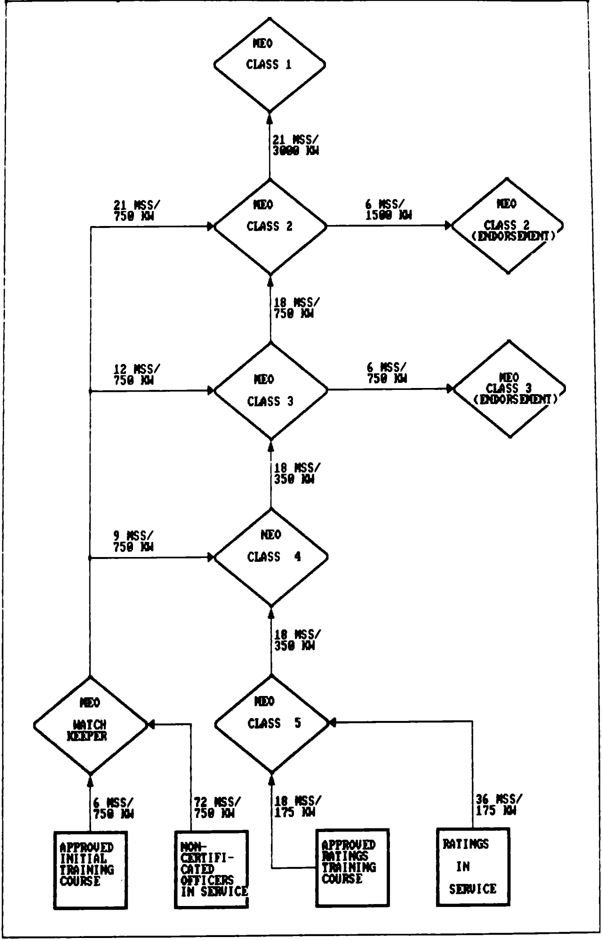


TABLE 1 : LIMITATIONS OR EXISTING CERTIFICATES OF COMPETENCY.

| CLASS OF CERTIFICATE | RANK | TRADING AREA | REGISTERED PROPULSION POWER (KW) |
|---|---|---|---|
| FIRST CLASS ENGINEER | CHIEF ENGINEER<br>SECOND ENGR<br>WATCHKEEPER | ALL TRADES | NO LIMIT |
| SECOND CLASS ENGINEER | CHIEF ENGINEER | FOREIGN GOING | 750 - 3000 KW |
| | | HOME TRADE OR LOCAL TRADE | NO LIMIT |
| | SECOND ENGR<br>WATCHKEEPER | ALL TRADES | NO LIMIT |
| THIRD CLASS ENGINEER | SECOND ENGR | FOREIGN GOING | 750 - 3000 KW |
| | CHIEF ENGINEER | FOREIGN GOING | 750 AND BELOW |
| | WATCHKEEPER | ALL TRADES | NO LIMIT |
| FOURTH CLASS ENGINEER | SECOND ENGR | HOME OR LOCAL TRADE | NO LIMIT |
| | WATCHKEEPER | ALL TRADES | NO LIMIT |
| FIRST CLASS ENGINE DRIVER | CHIEF ENGINEER | HOME OR LOCAL TRADE | 3000 KW AND BELOW |
| | SECOND ENGR | FOREIGN GOING | 750 KW AND BELOW |
| | | HOME OR LOCAL TRADE | NO LIMIT |
| | WATCHKEEPER | ALL TRADES | NO LIMIT |
| SECOND CLASS ENGINE DRIVER | SECOND ENGR<br>OR<br>WATCHKEEPER | HOME TRADE OR LOCAL TRADE | NO LIMIT |
| THIRD CLASS ENGINE DRIVER | CHIEF ENGINEER | HOME OR LOCAL TRADE | 350 KW AND BELOW |
| | WATCHKEEPER | HOME OR LOCAL TRADE | 3000 KW AND BELOW |

TABLE 2 : LIMITATIONS OF THE PROPOSED MARINE ENGINEER OFFICER (MEO) CERTIFICATION STRUCTURE

| CLASS OF CERTIFICATE | RANK | TRADING AREA | REGISTERED PROPULSION POWER (KW) |
|---|---|---|---|
| MEO CLASS 1 | CHIEF ENGINEER<br>SECOND ENGR<br>WATCHKEEPER | ALL TRADES | NO LIMIT |
| MEO CLASS 2 (ENDORSEMENT) | CHIEF ENGINEER | ALL TRADES | UNDER 3000 KW |
| | | NEAR COASTAL TRADE | 3000 KW AND OVER |
| MEO CLASS 2 | SECOND ENGR<br>OR<br>WATCHKEEPER | ALL TRADES | NO LIMIT |
| MEO CLASS 3 (ENDORSEMENT) | CHIEF ENGINEER | NEAR COASTAL TRADE | UNDER 3000 KW |
| MEO CLASS 3 | SECOND ENGR | ALL TRADES | UNDER 3000 KW |
| | | NEAR COASTAL TRADE | NO LIMIT |
| | WATCHKEEPER | ALL TRADES | NO LIMIT |
| MEO CLASS 4 | SECOND ENGR | NEAR COASTAL TRADE | UNDER 3000 KW |
| | WATCHKEEPER | NEAR COASTAL TRADE | NO LIMIT |
| MEO CLASS 5 | WATCHKEEPER | NEAR COASTAL TRADE | NO LIMIT |
| MEO WATCHKEEPER | WATCHKEEPER | ALL TRADES | NO LIMIT |

## 4.4 Some points about the present MET(Engineering) system.

### 4.4.1 An inherited model

The marine engineering cadet training system that we have adopted from the British has not changed in substance but only in form. Could this system be enhanced or improved? In the light of technological developments, social evolution, and the ever changing educational environment of many countries, should the system be changed or modified? This alternative cadet training scheme originated in the United Kingdom at a time when technical education was not even in practice. A system of education and training rooted in the time when technical education was nonexistent can reasonably be regarded as suspect. This is especially so when the UK had changed their MET systems a couple of years ago. No major review has taken place. It lacks the methodology and systematic approach that normally is found in well designed technical courses. It is probably outdated and a review seems necessary.

The system has many disadvantages. Training tends to be emphasized and very specific to the ship. Educational objectives tend to be sidelined. Fundamental subjects like mathematics and science are not given their due treatment as is required for higher education. Without a sound building of these fundamentals, the treatment of professional courses has tended to be superficial. This system was found by many ship owners and operators to be adequate and so for many years the system was left unchanged.

In Malaysia too the system of education and training for marine engineers had been left intact. So why then is there a need for change now?

### 4.4.2 Changing Technology

The ships today are substantially different from those of yesterday. Chapter 2 dealt with some of the principal technological advances that have come to be permanent features of a shipboard installation. Any worthwhile curriculum has to address this matter. Then the necessary adjustments should be made to reflect the changed situation. Only then may the relevance of this type of vocational higher education and training be maintained.

### 4.4.3 The complex international legal environment

The increased activity of the International Maritime Organisation (IMO) to improve the maritime sector has to be accounted for. 'Cleaner oceans and safer shipping', the organisation's motto, briefly describes the extensive work of the organisation. A series of globally accepted conventions have since come into force. The increasingly legal environment has affected many shipboard operations. An ample knowledge of the legal implications and working of the conventions and their effects on ship operation becomes imperative. A large number of amendments to these conventions has arisen out of technical innovations and practices. These are now part of the enlarged legal environment. They too must be given due notice in the curriculum.

### 4.4.4 Changing shipboard manning and skills

The worldwide trend of manning reductions has started. It is still continuing and seems headed towards previously impossible targets. Manning levels of a 6-man crew are being targeted in some advanced countries. Advanced technology and a reappraisal of shipboard organisation and tasks put this goal within the realm of reality. The invasion of microprocessors into these modern shipboard systems necessitates a review of the current curriculum. All the fundamental and professional knowledge areas in the curriculum need to be redressed. Modification and enhanced learning must now take place in these areas to ensure that pace is kept up.

Changes in manning structure and levels demand changes in the clustering of skills. It demands also the enlargement of the body of knowledge required by different ship officers. For example where the electrician is deemed unnecessary, then his skills and experience must be taken over by some other person. This is to ensure that the overall efficiency and effectiveness of the shipboard human resources remain intact. Hence continued safety and protection of the environment can be ensured by minimising accidents.

### 4.4.5 The Malaysian marine engineer - his needs

The average Malaysian marine engineer spends an average of about 8 years at sea after diploma. This length of sea service is not likely to increase. The reasons are the increasingly restrictive social environment and shipping practices of reduced port turnaround times. This unattractive side of the profession, argues Grey (10), must be recognised by the shipping companies. It must be taken into account in maritime industry management. Equally important, it should be recognised by the MET system when drawing up the relevent curriculum. It should take into account the very real fact that the seagoing part of a marine engineer's career is of a limited duration. A transfer from the sea should be regarded as a gain in the overall industry. He should have sufficient educational capability to be absorbed into a shore appointment. Shipping companies, teaching institutions, marine administrations, marine equipment makers and classification societies are some of the traditional companies that need the experienced marine engineer. He should also be given sufficient fundamentals to enable him to embark on other maritime related areas. Maritime law, transportation, arbitration or ocean sciences are some of the areas that can benefit.

At this juncture, it will probably be interesting to recall the responses of the traditional maritime countries in the flux of the present situation. This has been detailed in Chapter 3. It can give a useful basis of comparison on which to base a preliminary response. The basis must be formed considering the local environment, resources, economic and social conditions. The changes must be acceptable to all parties concerned, namely, the government, the shipowning community, the unions and the future marine engineer.

Only by putting forth a course that is satisfying, with rewarding prospects , can young people with the required qualifications be attracted in sufficient numbers to fulfil the needs of the maritime industry.

# CHAPTER 5: PROPOSED TRANSITIONAL MEASURES.

## 5.1 Continued Separation or Integration?

From Chapter 4, it is apparent that the MET (Engineering) system in Malaysia possesses considerable scope for development. The wide geographical and administrative separation between two complementary engineering wings is seen as a serious handicap. The excellent workshop and laboratory facilities at one location are beyond the effective utilisation of those at the other. There has been too little centralised coordination, planning and organisation as far as the marine engineering education and training is concerned. The two marine engineering wings in PUO (Polytechnic Ungku Omar) and ALAM (Malaysia Maritime Academy) have grown and developed relatively isolated from one another. Whilst the growth and development is sizeable and has a dynamism of its own, unless more coordination and planning is implemented, the situation may worsen. By then drastic abrupt intervention may be inevitable.

Though it can be said that the areas of specialisation are different with the PUO engaged in the pre-sea marine engineers MET (Maritime Education and Training), and the ALAM primarily involved in the post-sea courses, they can coexist together. However the approximately 40 students per year that moved through the system certainly do not justify the existence of 2 independently run, widely separated marine engineering wings. Furthermore the only set of students involved are the same group from the PUO, ultimately arriving at the ALAM for the post-sea higher certificates of competency. The numbers arriving at ALAM are much lower, having suffered the effects of dropouts and high rates of attrition that are an unfortunate characteristic of the profession.

In the writer's opinion based on the experience of studying MET institutions in the developed world, there is no other like situation as present in Malaysia. Most institutions in the USA (United States of America), France, FRG (Federal Republic of Germany) and others run simultaneous pre-sea and post-sea courses in marine engineering, marine transportation and navigation. Can MET (marine engineering) in Malaysia defend the uniqueness of her position?

## 5.2 The Problems of Separation

In the writer's opinion, the existing engineering setup in Malaysia merits the utmost consideration with a view towards integration or consolidation as was recently practised by, among others, the Netherlands and the United Kingdom. Not only are vital and scarce human resources and teaching equipment under-utilised and under-productive, but the separation deprived the engineering MET many advantages and strengths that accrue to a regularly managed integrated MET college.

So serious is this matter, that the effects of this continued separation are discussed under the following headings.

### 5.2.1 Effects on Infrastructure Development

Geographical separation and administration division make for increased problems as far as infrastructure planning and development and utilisation are concerned. Due to the often small numbers of students catered to, it is often very difficult to justify on economic grounds the acquisition of new and effective teaching equipment. It is widely practised that the school's budget is allocated according to the population of students in the schools concerned. This is particularly true in the ALAM where budgetary allocation is often lower than expenditure and the developmental budget has been minimal in the last few years. This is a serious impediment to the ability of the marine engineering section to respond to any new demands.

### 5.2.2 Effects on Educational and Training Objectives

The number of teaching staff for marine engineering in ALAM is small, reflecting the fewer number of courses and students. In a similar way, the number of staff in PUO, although numerically bigger, is still small, as the department is not a major one in the college. Both sets of staff however face similar problems in terms of staff development, promotion and academic enrichment opportunities.

The staff at the ALAM has more shipboard experience and possesses certificates of competency as chief engineers. However the staff at the PUO has more academic based qualifications with less shipboard experience. Each type of qualification is very important in its own right as was discussed in Chapter 4, but on its own tends to stifle development of the students. After all, the graduates need a balance of the academic and professional capabilities to enable them to perform competently in their future role as marine engineers. This, among other things, could only be achieved by a college that possesses the right combination of teaching staff.

So it may be maintained that the students have suffered in vocational and professional terms during their stay in PUO and then returned to face a different set of problems at ALAM.

Opportunities for promotion and staff development through study leave, upgrading courses and other seminars are often less available. This could be due to the apparent unimportance of the two sections concerned. Fewer opportunities mean less motivation and possible degradation in the standards of the course. Vital human resources are not giving their proper contribution towards the objectives of the courses.

### 5.2.3 Effects on Courses Development

There are still under review many short courses recommended by the STCW 1978 convention that are not yet implemented in Malaysia. Many of these courses need a significant engineering input to be successfully implemented. The list of these courses is given in para 5.5. With the continued geographical and administrative separation, the engineering wings of both colleges are too feeble to be able to make a positive response. Hence, thus far, the engineering wings have neither planned nor organised any of these STCW courses.

In short, the development of the mandatory STCW short courses is not being attended to and participated in proportionately by the engineering wings. This is a serious handicap and is likely to affect the implementation of many bivalent short courses, for example the shipboard management and the gas tanker courses.

With the rapid technological changes that engulf the world today, many of the marine engineers are in danger of quickly losing touch and becoming antiquated. The interim remedy is possibly to mount a program of retraining, upgrading and value-added modular courses of short duration. Our marine engineers will become increasingly unfamiliar with the modern shipboard technology unless measures are taken accordingly. The commencement of this range of short courses can effectively redress this lag in technological awareness and updating. This will thereby increase confidence in the safe and effective operation and maintenance of the modern ship.

### 5.2.4 Effects on MET in general

This continued separation of complementary marine engineering education and training facilities is likely to hamper seriously the response of the general MET to meet the future demands. The effect on the development of short courses is already highlighted in the previous paragraph.

The long term effects are more serious. The ability to offer new socially and economically acceptable courses is severely impaired. The worldwide and nationwide expansion of educational opportunities resulted in higher public expectations of higher education. MET in general will suffer from an incapability to offer courses of sufficient standards to attract more capable students. The maritime industry is then likely to suffer from less growth and vigor relative to other industries. The situation for the marine engineering sector will be aggravated based on the public's perception of a weakness due to the lack of existence of a coherent and integrated structure of education and training. The better students have a tendency to precipitate to courses of perceived higher quality and prospects than the ones that do not exhibit these characteristics.

This is a worrying and unhealthy trend as maritime engineering and operation has always and will remain a significant and important maritime function.

## 5.3 The Agenda for Immediate Attention.

Recognising the weakness of the present setup, the writer is of the opinion that swift remedial steps must now be taken. These steps should include the following.

1. Integration of the MET (Engineering) wings.

2. Cooperation and joint conduct of courses and examinations.

3. External linkages with other agencies.

3. The development of a comprehensive staff development program.

## 5.4 Integration - the way ahead.

This must surely be one of the top priorities in the revitalisation of the MET (Engineering) system. Only by a concerted and coordinated response can the demands of the modern maritime industry be met with suitable results. Perhaps to delay this physical restructuring exercise further is to retard the progress and propagate the inefficiencies of the present system. The problems of the continued separation of the two marine engineering wings was emphasised earlier.

It is well known that this state of affairs is already recognised and is definitely not a new problem. It is a problem that periodically raises its head and is acknowledged, but then sadly becomes immersed in the deep again. Hopefully this paper can promote further discussions and reiterate the need to take action.

The restructuring exercise of vocational institutions in the Netherlands can throw some pointers on this matter. Under a Dutch government directive, a process of scale expansion, specialisation and concentration of vocational higher institutions was started in 1983 (Putten, 27). Many of the smaller institutes were forced to amalgamate with other colleges of like specialisation to form bigger units. The main aim of the exercise was to bring about a qualitative and quantitative strengthening of the higher vocational institutions. The number of institutions was drastically reduced from a few hundreds to about a dozen. How the institutions were to amalgamate was left to their choice and negotiation. The other objective of the exercise is to reduce costs in the education budget due to economic difficulties. Another aim was to allow for a more flexible response to the changes in the demand of higher education. A better match between the educational supply and demand of the types on the job market is another target. The Dutch engineering and nautical colleges were first integrated from nine to six. This number finally became four on completion of the exercise. Malaysia, unlike the Netherlands, does not face the problems of educational demand contraction due to demographic downturn. Institutions need not be reduced in number but concentrated, rationalised and consolidated. Malaysia, like the Netherlands, also has limitations on the public education expenditure. Whilst the good economic years brought about generous increases in educational budgets, the recession years tended to witness the cuts in expenditure. An institution, effective and efficient, can better adapt to the fluctuating supply and draws less from the national coffers. Only by having one integrated and easily identifiable structure can there be orderly growth and expansion.

**5.5 Cooperation and Joint Conduct of Courses and examinations**

It is regrettable that although the objectives of the two marine engineering wings are identical, namely the education and training of manpower for the shipping industry, there is at present minimal cooperation and academic linkages between the two. This could be due to the geographical separation of about 300 kilometers. Scarce and valuable resources at both ends are being under-utilised and the motivation of staff is not encouraging.

Some of the proposed courses listed below could be handled jointly using the synergistic qualities and assets available in the two wings. The resulting course is more likely to be a well balanced course that the maritime industry will welcome.

### 5.5.1 Courses that could be offered.

Some of the courses that could be considered seriously for offer by ALAM and PUO are the following:

1 Oil tanker familiarisation
2 Advanced training program for oil tankers
3 Gas tanker familiarisation
4 Advanced training program for gas tankers
5 Maintenance planning and execution
6 Engine room simulator
7 Advanced fire fighting
8 Survey of machinery installations
9 Survey of electrical installations
10 Survey of fire appliances
11 Chemical tanker familiarisation
12 Advanced training course for chemical tankers
13 Maritime training safety- offshore
14 Human relationships
15 Fuel combustion efficiency
16 Tonnage measurements
17 Fleet safety management
18 Human resources management
19 Electronic data processing
20 Marine electrical practice
21 Automation and control
22 Marine electronics
23 Diesel engine operation and maintenance- Fishing vessels

The above mentioned courses are not targeted towards the same group of maritime personnel. Only selected persons who need the different training for different missions need attend. A person going on board a gas tanker, for instance, will be required to attend a gas tanker familiarisation course. If his duties and responsibilities involve cargo and cargo equipment then an advanced course has to be taken (STCW, Res.12).

All the above courses, except the last four, are identified by the IMO for the realisation of maritime education and training objectives worldwide, particularly in the developing countries. In fact the Norwegian government to further strengthen the MET framework has commenced work on the writing and design of model syllabuses for all the courses. These model syllabuses covering the detailed learning objectives, instructor's manual and compendium will have a beneficial impact on the global standards of training and certification as espoused by the STCW 78 convention (TCD, 32 ).

Some of these courses are at present ready and have been distributed to all maritime institutions worldwide. Many of the others are currently in various stages of readiness.

A great deal of activity is likely to be in this area of short course development especially when Malaysia becomes a party to the STCW 78 convention.

Whilst the target group is very big, it is probable that the teaching resources are spread even thinner than ever. In fact on certain courses, external specialist lecturers may have to be recruited. IMO in collaboration with the Trieste Maritime Academy may be able to help in this aspect. Whilst external help is always welcome, the formation of a group of local experts is essential for the long term interest of the country.

## 5.52 Examinations

The trend worldwide to allow MET institutions more responsibilities and control in conduct of examinations for seafarers is commendable. The UK and Australia examination systems have evolved to the stage where all written examinations for certificates of competency are now delegated to the academic institutions.

In Malaysia the Marine department is also amendable to delegating examination responsibities to the MET institutions. The examinations will include possibly all the written papers of the various marine engineers classes up to the First class. This is a very positive rationalising step. Staff at the two marine engineering wings will have increased job enrichment opportunities and possibly better morale.

The integration of the examinations functions into the course structure can help to strengthen and motivate learning of the students. This will also allow for better cost effectiveness and relieve the marine department of this time consuming function. They are then able to concentrate more on the important regulatory and administrative functions. The writer believes that such an enlightened delegation will result in a stronger and better MET (Engineering) system in the long term.

## 5.6 External Linkages .

MET institutions cannot exist in a vacuum. In fact the inter-relationships between the academies and the industry and the maritime administrations are very vital to the continued relevance and efficiency of the MET programmes. Obsolescence and maladjustment of training programmes with respect to the rapidly changing societies will be obliterated. Any changes in the demands of society will be communicated and adaptation measures could be taken. Disparities between supply and needs will be minimised. In fact, a Technology and Manning study in UK (United Kingdom) found that in countries where changes have been encouraged and managed, a common feature has been the collaboration of the various parties involved. These parties include the government, employers, seafarers organisations and the training institutions (D.O.Tp, 3 ).

Important feedback and information from the regulatory bodies and industry can further fine tune the design of the curriculum and promote both internal and external efficiencies. Weaknesses in the system can be identified and rectified. The supply of manpower to the industry could be better regulated if this flow of information is maintained. Skilled labour shortages could be eliminated. The need to employ foreign nationals would be reduced. Valuable foreign exchange will then be conserved. Hunting (15), for instance, advocates the use of a series of surveys and questionaires for employers and employees in evaluating the efficiency of training programs. The success of such evaluation must surely depend on the continuing cooperation and working relationships between the parties.

These linkages are going to be even more important as new technological and legal environments are coming in place. What is the degree of automatic control and automation to be specified in new tonnages? What are the types of secondhand tonnage to be acquired? The expansion policy of the companies is another type of information that could form part of the flow. The complex legal environment in which future ships will operate necessitates closer working relationships between the parties. The implementation of new conventions, and the increasing volume of amendments, means that information becomes obsolete quickly unless constant updating is carried out. Academic staff tend to work in a shell. Any links and communication to maintain their sense of balance in the flux of today's world is certainly rewarding.

Exchange of views and information between these parties is facilitated through many channels. Many, in fact, are already in practice. Dialogues and sponsorship meetings are held frequently. Seminars, conferences and short talks are less frequent. Learned societies like the IKMAL (Malaysia Maritime Institute) and the IMarE-RINA (Institute of Marine Engineers and Royal Institute of Naval Architects Joint Branch) could be the forums for discussions of ideas, identification of problems and formulation of possible solutions.

Placements of staff among the parties can enhance the required linkages. Appreciation of the functioning and problems of other institutions could be improved. For academic staff, this could be an upgrading and enriching experience the results of which could be reflected in better quality courses.

Maritime academy linkages with one another must continue to be forged. Regional cooperation of academies ensures working relationships. Staff exchange programmes could be organised. Certain cost ineffective courses could be held jointly at a regional level thereby obviating duplication of expensive and scarce resources.

The past graduates of the WMU (World Maritime University) returning to their home countries should continue to maintain a worldwide network of important linkages. Their relationship with the WMU will be a very important one.

## 5.7 Staffing and Staff Development

Among the many effects of the administrative and geographical separation of the engineering wings is the staffing and staff development aspect. This arises due to the different governing bodies of the two institutions. Unless the schemes of service are uniform, there shall continue to be the unequal distribution of teaching resources in the two wings. The unattractive nature of salary schemes offered to nautical and engineering teachers is by no means unique to Malaysia. Various international maritime leaders have lamented this reality. Many schemes of employment just could not attract suitable teachers. So MET programmes in many developing countries have not prospered. Whilst Malaysia could claim to have a favourable scheme going especially at ALAM, a recent BOG decision may have made it less attractive. That decision was to withdraw the incentive allowance for holders of First class certificates. The implication of this withdrawal is still not known.

Whether suitable staff can still be attracted to serve in the schools is now more uncertain. This is unsettling especially when the demand of new STCW short courses and other important value added courses calls for more experienced and qualified staff.

The selection and recruitment of staff should now focus on persons with broader experience beyond the basic bachelor degree or First class certificate. This is necessary to ensure that urgent courses could be implemented at short notice. The areas deemed valuable, among others, are steam power plant operation and maintenance, gas tanker, oil tanker, chemical tanker and other specialised operation and management. Those possessing special experience in automation, control, electrical and electronic systems will be equally valuable. Persons having previous experience in maritime administrations or surveying organisations may be useful. Only then can the human resource base be sufficiently broadened to support and enhance future courses.

The initial engineering staff members at ALAM are expatriates working on a contractual basis. However most had opted not to renew their contracts. Their places were taken up by the qualified Malaysians. This situation is better as the turnover tends to be lower. However this trend may no longer be true after the BOG decision. Some semblance of an incentive scheme must continue if the turnover is to be kept low.

The support staff to run the laboratories, workshops and other facilities also must have an appropriate scheme of service. They help to make the learning environment more conducive and productive. Learning could be hindered by any unintended interruption in the long chain of the learning process.

"Local staff should be encouraged by the wider possibilities for career development and enrichment. Only then can the enthusiasm and morale be kept high so there will be the capacity to respond to increasingly changing needs and to fulfil the objectives of the institutions". The above finding by the OECD (21) could not have better described the need for a dynamic staff development programme. Another OECD report (23) makes this statement for even the technologically advanced countries. It states "that there is a growing need for individuals to have opportunities for retraining at various stages in their lives. The development of the microprocessor technology appears to accentuate this trend". The ILO/UNESCO joint committee of experts supported this view by seeking to promote continued training for teachers to enable them to cope with their changing responsibilities (ILO, 16). Only then can it be ensured that optimum use is made of available and future resources, to achieve the objectives of the academy.

Such programmes could be either in-service or pre-services or both. They should address the teaching, technical and management competencies of the respective individual.

# CHAPTER 6 : Proposed Long Term Measures.

## 6.1 Policy and Institutional Framework

The need for a clear and defined maritime policy is even more urgent today. The lack of such a policy has caused some of the problems faced today. The often quoted separation of the MET (Engineering) wings is an example. Narrow interests are likely to be more keenly guarded. The UNCLOS III convention has delineated large areas of originally high seas for coastal state economic exploitation. Malaysia is the beneficiary of large areas of seas. Multifarious activities in the Malaysian EEZ (Exclusive Economic Zone) will increase. Fishing and offshore hydrocarbon exploration and exploitation activities are expected to increase dramatically.

The lack of a clear and objective institutional framework to coordinate and manage the multiple uses of the sea is likely to hinder its optimum utilisation. Maritime education, both specialised and general, must also be given clear directions. Without a clear coordinating framework, sectorial interests are likely to prevail. This will ensure the proliferation of a large number of small training centres, each catering to the specific sectorial interests. For instance, the Agriculture Ministry will have its own fisheries and fishing training centres. Likewise, the Transport and Energy and Mines Ministries will have their own courses of port and offshore related courses. This will be very inefficient and expensive. Duplication of scarce resources will be unnecessarily aggravated. This scenario hopefully will not be realised. Many maritime academies, including the Australian Maritime College and the Szczecin Maritime University (SMU), have demonstrated that a single institution can handle all these courses efficiently and effectively.

The Maritime Academy of Malaysia (ALAM) has been identified as the leading educational institution in the maritime sector. This intention is amply illustrated in the provisions of its charter. While the charter is a very important document, it lacks the power to implement initiatives and changes for the benefit of the maritime industry. In the writer's opinion, the long standing inability to integrate the two engineering wings is an indication of this lack of influencing power.

### 6.2 Institution Fit

The two engineering wings are seen to have institutional fit. One complements the other and strengthens the whole. Together they will provide a very sound foundation on which other activities could be generated. Its effects on the MET in general is likely to be very positive. Courses could be implemented, as the resources are strong and concentrated on one campus. It provides the base for mounting the whole range of courses that the maritime sector needs - be it fishing, offshore related or STCW mandatory short courses.

Why, if it is so good, are they so far not integrated? Aside from the charter, the vested and entrenched interests at the PUO campus seem to be insurmountable. Social disruptions and costs are believed to be excessive. A heavy initial capital outlay for infrastructure development at the ALAM seems to be inadmissible. Are these factors really that great so as to preclude the making of a positive decision of integration? The writer thinks otherwise. A closer analysis should bear out that relocation integration is likely to bring out more benefits than costs in the long term. A cost benefit analysis of this integration exercise should be conducted in order that a more realistic picture of the situation will emerge.

### 6.3 Need for new courses

In the years after independence, Malaysia has seen a rapid expansion of educational facilities and opportunities. All levels of educational infrastructure are enhanced. The number of universities, for instance, have been increased from one to seven since independence. Enrollment has increased. In 1985, tertiary institutions have a total enrollment of 67,000. Another 32,000 students are with foreign universities in 45 major countries in the same year (Gonzalez, 9).

This unprecedented expansion and optimism has not been matched in the maritime sector. No new courses have been started except the shore based marine technology courses by the Malaysia Technology University (UTM).

This is certainly an undesirable situation. The maritime sector has to compete with other sectors for the infusion of new blood and talent. The absence of a degree level type qualification in marine engineering has not helped. Students tend to go for faculties which offer what they reckon to be a marketable paper - a degree. This state of affairs will have serious consequences in the long term.

What type of a degree course should be offered - a specialised or bivalent one? Chapter 3 documents a strong general trend among the developed countries towards a bivalent MET programme. France and the Netherlands have theirs. The FRG has just started one. The USA is offering a choice at the USMMA facility. High labour costs, demographic downturn and a suitably high technological base have facilitated the adoption of such training in these countries.

Malaysia, on the other hand, has an expanding population and a relatively lower manpower costs. Furthermore a fragmented MET (engineering) structure is not conducive to a successful bivalent programme. The writer believes that, although the adoption of a bivàlent MET programme is inevitable in the future, a degree course in marine engineering is more appropriate at the present moment.

## 6.4 Additional considerations for the degree programme.

The increased volume of knowledge that should rightly be incorporated into the syllabuses will overwhelm the traditional diploma programme. For this reason, it is necessary to revise the entry requirements. Only candidates possessing the Higher School Certificate will be considered. This will keep the duration of the programme within the usual four year period.

The technological advances must be reflected in the curriculum. Among the list of desirable qualities, Parkes (26) believes that the modern marine engineer needs to have an educational base of sufficient depth to enable him to accept new technology. This implies that the general science base of physics and mathematics has to be reinforced. On top of that, electronics and microelectronics have to be beefed up. Electronics data processing, communications and data handling knowledge and skills too must be imparted.

Modern ship control systems, and their components and the technology involved can only be clarified if the basic fundamentals are properly understood. This understanding could be reinforced by the provision of sufficient demonstration equipment and laboratory exercises.

The increased regulatory regime worldwide makes an understanding of maritime law essential. Gold ( 8 ) believes that the regulatory framework of modern maritime transport is undergoing very fundamental changes. These changes are going to affect not only shipping but the operational responsibilities of mariners. He calls for the 'extended base of maritime law' to be made an element of the modern maritime education and training. The importance of the possession of such knowledge is part of the STCW 78 convention.

Another requirement of the modern marine engineer officer, stated by Parkes, is the need to have management skills especially for the senior officers. The trend towards reduced manning means an increasingly restrictive and isolated social environment with potentially greater tensions. Management of such scarce human resources demands better skills. The importance of ship and personnel management and organisation is the subject of one paragraph of regulation of the STCW convention.

Economics, humanities, social sciences and basic navigational knowledge should form part of the curriculum. This is to ensure that modern marine engineer officers have a much more balanced and broader outlook. The officers must be able to interact effectively at all levels in all professional and social situations. The much publicised tendency of introvertness of the marine engineer needs to be obliterated by suitably designed educational programmes.

The completion of an engineering project work and its report will also be a mandatory feature of the degree course. Such a project requirement is necessary to encourage the thinking and problem solving capabilities of the students. It should force students to analyse, synthesize or formulate solutions in addition to developing his skills at organisation and research.

The writer proposes a four year degree programme. The details of this programme are given in Appendix 5. Graduates of this programme will receive a nationally identifiable degree in marine engineering on top of a basic watchkeeping certificate.

# CHAPTER 7

# CONCLUSIONS AND RECOMMENDATIONS

## 7.1 The Verdict

It is no choice of ours that the technological and other changes to the maritime industry are so rapid, but if we ignore them, we are letting ourselves slide backwards. The technological changes have been discussed earlier and the strengths and weaknesses of their adoption should be taken into account in our future response. Otherwise we may irretrievably lose our opportunity to maintain our position in the mainstream of technological advance. Many countries have addressed this aspect of change. Their experience gives invaluable pointers on how to manage the change as best as we can.

If technological adaptation of our curriculum is the only criteria, then the proposal of a degree level course would not be necessary. Considerations must include the social and economic changes that have taken place. The expectations of higher education are higher than before. People expect to have nationally recognised awards that could be identified easily. Furthermore the proposed degree programme is rigorous and offers intensive courses that any successful graduate would be proud of. The continuous inflow of the right calibre of entrants into the profession must continue. This is necessary to ensure the continued prosperity of the industry. The right calibre candidates can only be attracted by the right degree programmes.

The increasing shipping tonnages and strong economic base will ensure that the graduates will not join the ranks of the unemployed. While there are thousands of unemployed degree holders in the country, there is still much room for marine engineers. This is in view of the fact that there are a considerable number of foreign marine engineers in the Malaysian flag ships and the expansion of tonnages anticipated in the future.

## 7.2 Integration emphasized

Though the infrastructure and human resources are available in Malaysia, the overall system is too inept to respond effectively to future global trends. The trend towards bivalent training is already in considerable force in many maritime countries. This type of training will inevitably be adopted by Malaysia in the future. By then if the integration of the two marine engineering wings is not in place, MET (Engineering) in Malaysia will not be emplaced to take advantage of this type of training. After all, bivalent officers on the appropriately modern ship could increase significantly the economic competitiveness of ships by a reduction of manning levels.

From the above it can also be concluded that the continued existence of MET (engineering) facilities in two separated locations is both expensive and inefficient. It shows the past deficiency of educational planning. More importantly it shows the lack of a masterplan to guide the growth of the maritime industry as a whole.

Perhaps the formulation of a MET policy will be necessary to ensure more orderly growth and expansion in the future. The entry into force of the UNCLOS will further see increased activities in the maritime sector. Offshore and fishing activities are likely to increase as exploration and exploitation of the EEZ increases. Maritime safety and pollution prevention will be major issues and MET facilities will be strained further. So unless a clearcut policy on the maritime sector is formulated, it is difficult to conceive how the maritime industry interests and objectives can be well served and achieved.

Response to the conducting of the very important STCW courses has been minimal so far. The participation of engineering in this area must now be attempted. The generally weak engineering set-up is not healthy for the overall MET. Whilst joint conduct of these courses via cooperation and use of one another's resources is practical, the ideal long term solution would still be an integrated national maritime academy. As it stands, the logistics is extremely heavy. Joint courses conducted during the transitional period will be less efficient but hopefully be of a temporary nature only.

Integration by relocation of PUO marine engineering facilities will ensure an orderly and systematic expansion of resources and courses. This will be a direct result of a more orderly budget allocation to an easily identifiable academy. Equipment such as simulators identified as necessary would be more justifiable if a more favourable student population and a bigger number of courses would be attained.

Human resources, which are a very important ingredient of a successful program, need revitalisation. Unless the staff feel strongly about the usefulness and importance of the role of their organisation, they may not be as dedicated and motivated as required. Conditions of service and promotional prospects are very important matters to be looked into to reduce staff turnover and increase staff morale.

Teaching staff also are affected by the rapid technological advances. They too need training and retraining to keep abreast of the changes. Only then can they harness the tools of modern technology to optimise their performances. Computer aïded learning, interactive study packages and distance learning programs are areas where educational practice seems to be heading. Pre-service and in-service upgrading programs for teaching, technical and management competencies must be enhanced

Only when all these processes are carried out and the various programs implemented, can we say that MET in Malaysia has arrived at a reasonable level to respond to the various challenges, the greatest of which is that posed by technological changes.

A quick review of the paper, first surveying the extent of modern technology on ships, then the international MET response and finally that of our own country, supports the following conclusions.

## 7.3 Conclusions

1. Whilst a MET (Engineering) system is basically in place, it is in need of enhancement. Only then can it fit into the modern technological age and continue to play the important role of educating and training the modern marine engineer.

2. The present set-up can be reorganised to respond effectively to the rapidly changing demands. These new demands take the form of important short modular courses, examinations responsibilities and a degree level programme.

3. The present Diploma type course is both outmoded and unpopular. A degree level type course should be more suitable in the light of technological response and additionally for social and economic reasons.

Knowing the weaknesses of the present system, the recommendations of the thesis must only be the following.

## 7.4 Recommendations

1. The long overdue process of **integrating the marine engineering wings** in the national maritime academy should be commenced soonest.

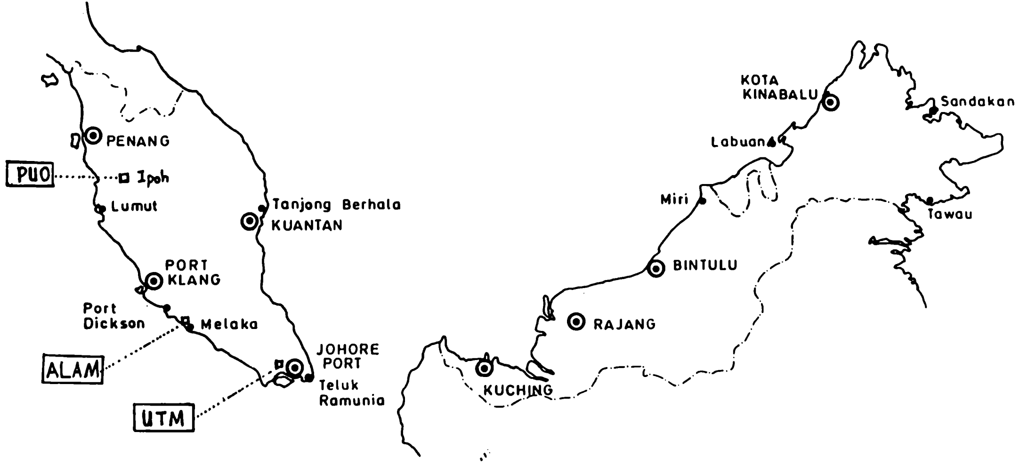
2. Using joint efforts, the marine engineering wings should conduct some of the more urgent **short courses** in the transitional period. They should then be better able to assume **examinations** responsibilities delegated by the Marine department.

3. A four year **Bachelor of Science (marine engineering) degree program** should be implemented.

4. The **formulation of a national MET policy** to ensure a more orderly and less disruptive response to the modern maritime environment should be initiated.

## MAP OF MALAYSIA

Location of MET Institutions




LEGEND :-

- Major Ports
- Principal Minor Ports
- MET (Engineering) Institutions

| APPENDIX 2 | TOTAL TONNAGE OF MALAYSIAN FLAG SHIPS FROM 1982 TO 1988 | | |
|---|---|---|---|
| YEAR | NO.OF SHIPS | GRT (THOUSANDS) | DEADWEIGHT (THOUSANDS) |
| 1982 | 329 | 1195 | 1634 |
| 1983 | 376 | 1475 | 2074 |
| 1984 | 429 | 1664 | 2410 |
| 1985 | 467 | 1773 | 2583 |
| 1986 | 498 | 1743 | 2506 |
| 1987 | 498 | 1688 | 2388 |
| 1988 | 499 | 1608 | 2226 |

SHIP TYPES INCLUDE : FISHING, FERRIES AND PASSENGERS, SUPPLY SHIPS AND TENDERS, TUGS, DREDGERS, LIVESTOCK CARRIERS, RESEARCH SHIP, OIL TANKERS, CHEMICAL TANKERS, GENERAL CARGO, PASSENGER CARGO, CONTAINERS AND VEHICLE CARRIERS.

SOURCE : LLOYDS REGISTER OF SHIPPING - STATISTICAL TABLES 1982 TO 1988

APPENDIX 3

## CURRICULUM OF THE POLYTECHNIC UNGKU OMAR (PUO) MARINE ENGINEERING DIPLOMA COURSE.

**First year**

English Language
Islamic Education
Mathematics
Engineering science
Engineering drawing
Workshop Technology I
Electrical Technology I
Heat & Fluid Technology I
Marine Engineering Practice
Naval Architecture I

**Second Year**

Islamic civilisation
Strength of materials
Mechanics of machiness
Steam engineering
Auxiliary engineering
Marine control systems technology
Marine workshop technology
Naval architecture II
Electrical technology
Internal combustion engineering

**Third year**
(Sea training on ships)

On board ship, they are introduced to the practical aspects of what they have learnt in the first 2 years. They acquired "hands-on" experience on the operation and maintenance of ships power plants, auxiliaries as well as practical aspects of ship construction and Naval architecture. Cadets have to follow a correspondence course given by the Polytechnic.

**Fourth year**

Mechanical technology
Internal combustion engineering
Mathematics
Drawing and design
Steam engineering
Naval architecture III
Marine engineering practice
Legislation
Marine control systems
Applied electronics
Electrical technology
Materials technology
Auxiliary engineering

APPENDIX 4

# The Charter of the Maritime Academy of Malaysia

*1. The Maritime Academy of Malaysia is established as a component part of MATES Foundation, functioning under the control and supervision of MATES Foundation. Designed as an academy for the teaching of various aspects of professional shipping, it is primarily meant to provide employed sea-farers with additional skill in and a more advanced knowledge of their occupation.*

*2. The purpose of the establishment of the Academy is the development and the enhancement of the education and training Merchant Navy Officers and Ratings and for that purpose the Academy may —*

*(a) conduct professional shipping courses and examinations in connection with these courses as it may deem fit;*

*(b) print or publish or assist in the printing or publication of reading materials on shipping and related subjects;*

*(c) formulate such guidelines as may be necessary to regulate the responsibility and control of the academic and teaching staff of the Academy and the policy on the selection and admission of students and fees payable in respect of the courses of study offered by the Academy; and*

*(d) carry out research on shipping matters.*

*3. As the Academy does not have corporate status, any functions that are to be undertaken in relation to the objectives and purposes of the Academy, being functions that can only be undertaken by a body corporate, shall be undertaken by MATES Foundation.*

*4. There shall be two committees to assist the work of the Academy. There are —*

*(a) the Consultative Committee and*

*(b) the Selection Committee.*

*5. The Consultative Committee shall comprise persons described in Part 'A' of the Schedule to this Charter. It shall, when required by the Academy, make recommendations to the Academy on the appropriate syllabus required in respect of any course of study, the manner in which examinations in respect of any course of study, may be conducted and any other matters relating thereto.*

*6. The Selection Committee shall comprise persons described in Part 'B' of the Schedule to this Charter. It shall, when required by the Academy, make recommendations to the Academy on the manner in which students are to be selected and admitted to the Academy and the appointment of staff members of the Academy.*

*7. At the end of each course, the Academy shall issue a certificate of attendance to a student who has completed the course of study to the satisfaction of the Academy and the Academy shall recommend to the Ministry of Transport for the issuing of certificate of competency.*

***(YAB DATUK SERI DR. MAHATHIR BIN MOHAMAD, SSDK, SPMJ, SPMS, SSAP, DP, DUPN)***
***Perdana Menteri Malaysia***

***15hb Ogos, 1981***

# SCHEDULE

**Part 'A'**

CONSULTATIVE COMMITTEE

*Policy, curriculum, training policy, research etc.*

**Members:-**

| | | |
|---|---|---|
| *1. Director of Marine* | — | *Chairman* |
| *2. Ministry of Transport* | — | *Member* |
| *3. MISC* | — | *Member* |
| *4. Ministry of Education* | — | *Member* |
| *5. Maritime Academy* | — | *Secretary* |

**Part 'B'**

SELECTION COMMITTEE

*For selection of students and recruitment of professional staff.*

**Members:-**

| | | |
|---|---|---|
| *1. Deputy Director of Marine* | — | *Chairman* |
| *2. MISC* | — | *Member* |
| *3. Ministry of Education* | — | *Member* |
| *4. Public Services Department* | — | *Member* |
| *5. Maritime Academy* | — | *Secretary* |

## APPENDIX 5

## PROPOSED DEGREE COURSE : BACHELOR OF SCIENCE DEGREE IN MARINE ENGINEERING

**Objective** : to provide the trainee marine engineer officer with a comprehensive course of education and training. This course will form the basis for his future executive responsibility, both ashore and afloat.

**Duration of course** : Four years including sea training as a marine engineer cadet.

**Entry requirements** : Higher school certificate or equivalent with passes in science and mathematics. A credit in English at ordinary level is preferred. All candidates must pass a medical checkup.

**Type of course** : sandwiched technology course with workshop and sea training.

**Awards** : The award of an Advanced diploma in marine engineering and a MEO watchkeeper certificate of competency shall be given after successful completion of the third year. The MEO certificate shall be issued only on completion of mandatory short courses as per regulation.
The award of the Bachelor of science degree (marine engineering) shall be given after successful completion of the final year.

## PROPOSED CURRICULUM

### First year (33 weeks)

Mathematics and statistics
Physics
Fluid mechanics I
Naval architecture I
Mechanics and stress analysis I
Electronic and electrical technology
Materials science
Engineering drawing
Workshop practice
Humanities
Economics

All students must participate in workshop training of eight weeks duration at an approved shipyard during the long vacation.

### Second year (40 weeks)

Mathematics
Computing
Applied thermodynamics I
Marine materials science
Fluid mechanics II
Applied mechanics and stress analysis II
Marine electrical engineering
Marine electronics and instrumentation
Naval architecture II
Marine engineering practice
Marine control systems I

Principles of maritime law

Shipboard organisation and management.

Maritime transportation

Principles of Navigation

**Third year**

Sea training as cadet for a period of nine months on merchant ships. Cadets must follow a distance learning programme. The programme consists of the following subjects.

Marine engineering

Machine shop

Electrical systems

Shipboard systems

Naval architecture

Deck operations for engineers

Refrigeration and air conditioning

**Final year** (40 weeks)

Marine engineering project

Maritime law

Maritime economics

Management and Administration

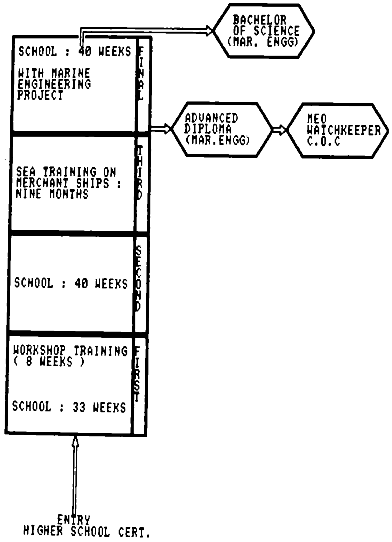
Marine control systems

Naval architecture

Marine engineering practice

Applied thermodynamics II

**STRUCTURE OF THE PROPOSED BACHELOR OF SCIENCE DEGREE ( MARINE ENGINEERING) COURSE.**



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