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TOWARDS A RATIONAL MARITIME EDUCATION AND TRAINING POLICY

(CHINA'S MET TODAY AND TOMORROW)

- OPEN TO THE WORLD
- LOOK INTO THE FUTURE

by

Su Xiao-hong

The People's Republic of China

A Paper submitted to the Faculty of the World Maritime University
in partial satisfaction of the requirements for the award of a

MASTER OF SCIENCE DEGREE

in

GENERAL MARITIME ADMINISTRATION

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

Signature: _____

Date: _____

Supervised and assessed by:
A. D. Couper
Professor
World Maritime University

Co-assessed by:
Dr. G.E. Moukhtar
Visiting Professor of WMU
General Director of AMTA

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INTRODUCTION

I. OBJECTIVE AND TASK

A rational maritime education and training policy contributes to and forms a part of a rational shipping policy, which in turn contributes to and forms a part of a nation's economic development policy. This is particularly important in the case of China in her present historic drive for modernization and rapid economic development. The success of the program depends largely on the development of science and technology as well as on the people who process and apply it. Education is the key. Another challenge that China's education sector will have to face equally is the fact that every year 13 million of young people will need their higher/vocational education and employment in the next ten years. Maritime education and training (MET) sector is unexceptionally duty-bound to use all means to produce more and highly qualified maritime personnel. Taking into the consideration the longer lead-time of MET, China's MET policy in the 1990s should be characterized by:

- rational structure
- opening to the world
- looking into the future

To achieve this we must have a clear knowledge of what is happening and what will happen to the world shipping and what rational MET structure means for the future.

Therefore, the first part of this paper is devoted to describing, analysing and discussing the changes and trends that will take place in the world shipping in the 1990s. The supply and demand of ships, of ship technology and ship operations, of seafarers and their qualifications as well as the operational policies that may influence all of the above are also analysed including the future international seafarer market.

The world's major MET systems, their practices and present/future changes are also given considerable discussions for the same purpose.

Part II and Part III concentrate on China's present and future development and policies adopted, the commitment of her shipping industry and the needs and possibilities of a rational MET policy.

II. LIMITATION AND SCOPE OF THE RESEARCH

However, in observation of the major economic, policy factors in shipping, the study does not cover all those involved but only the changes and trends that influence the quantity and quality of ships and manning which signify the quantitative and qualitative demands for MET.

Furthermore, in the discussions any detailed explanation and justification of ideas and thoughts which are generally accepted are excluded in order to avoid the voluminous content of the paper.

Political and climatical factors are excluded from consideration and assumption due to their complexity and unpredictability.

There are many limitations in collecting accurate, updated first-hand information and data. Most of them were acquired from various publications, pamphlets, periodicals and conference papers. For the forecasts not available, method of least squares, the average annual growth and other mathematical methods were used for trend extrapolation.

Despite the fact that MET is no longer limited on seafaring specialities and are dealing with the wider range of disciplines and technologies, the study is mainly concentrated on MET for ocean-going ship officers with very slight touches on other related specialities and MET for ratings. MET for inland water, costal water, fishery and offshore personnel are excluded because of the time and space constraints.

III. METHODOLOGY

This research has been conducted mainly through three different methods, that is, library research, practical research and statistical research.

Library research was undertaken mainly at the library in the World Maritime University.

Practical research was fulfilled during various field trips, on-the-job training, participation in several international conferences and workshops in eleven countries to more than one hundred institutions and organizations during the study and vacation time.

It also includes personal interviews with many experts, technical personnel, professors and visiting professors in different institutions and organizations as well as the colleagues at the World Maritime University.

Lastly, statistical research has been done under the guidance of Prof. Dr. A. A. Monsef, Prof. Dr.-Ing. F. Rickert, Dr. H. L. Beth and with the help of Mr. J. P. Bebiano.

IV. STUDY PLAN

Please see Fig. 0.1 which shows the flow of discussions and the logical/interrelationship between topics in different chapters.

V. GUIDES FOR REFERENCE

a) Due to the large number of papers, books and other literature resources that are involved and referred to, reference and bibliography (RB) are treated in such a way that they are categorized into five groups with code numbers and only major titles are listed.

For easy reference:

- (See RB 1.C-1) means the information was directly quoted from Paper 1 of Conference on Education and

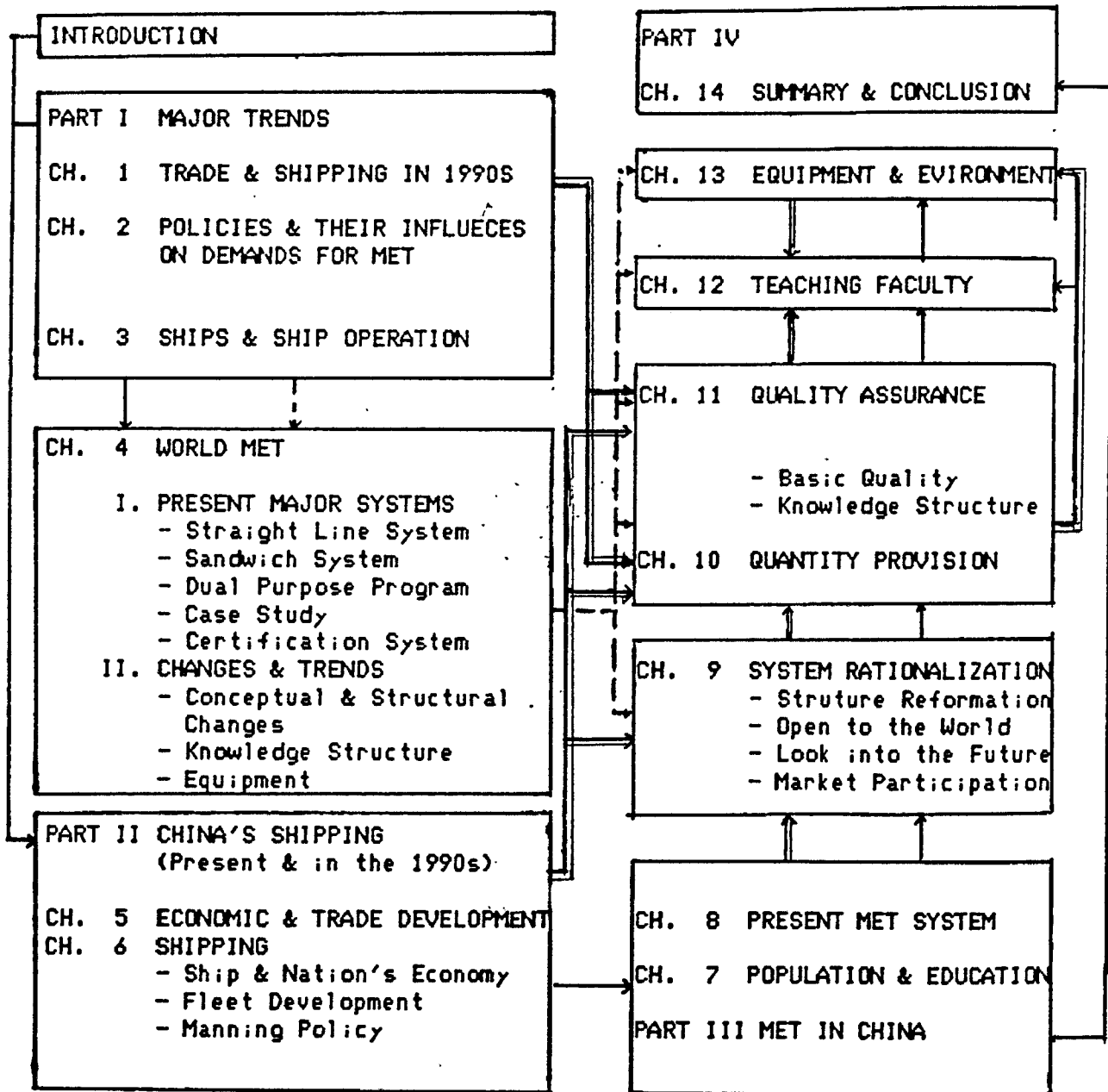
Training of Seafarers - What Policy for the 1990s.

- (Ref. RB 2.3 1/87, P.30) means the reference is taken from Page 30 of 1987 January Issue of FAIRPLAY.

b) During the discussion serial numbers are used for topics of reduced importance while alphabetic letters are used for topics of equal importance.

c) Figure or table orders are given on chapter base.

Fig. 0.1 CHART OF THE STUDY PLAN



- > Logic development of the study
- =====> Demands for
- - - - -> Reference for
- > internal
- > external

LIST OF ABBREVIATIONS

COSCO	China Ocean Shipping Company
COST	European Co-operation in the Field of Scientific and Technological Research
DO	Diesel Oil
DWT	Deadweight Tonnage
EDP	Electronic data processing system/network
EEC	European Economic Committee
FOC	Flag of Convenience
Fig	Figure/Graph
GMDSS	Global Maritime Distress and Safety System
GT/GRT	Gross Tonnage/Gross Registered Tonnage
HVO	Heavy Oil
IALA	International Association of Lighthouse Authorities
ILO	International Labour Organization
IMLA	International Maritime Lecturers Association
IMO	International Maritime Organization
INMARSAT	The Convention on the International Maritime Satellite Organization, 1976 (IMO)
ISF	International Shipping Federation
ITF	International Transport Workers Federation
LNG	Liquefied natural gas carrier
LPG	Liquefied petroleum gas carrier
MET	Maritime Education and Training
mn	million
NIS	The Norwegian International Ship Register
OECD	Organization for Economic Co-operation and Development
p.a.	per annual
PC	Personal computer
PSC	Port State Control
RB	Reference and Bibliography
Ref.	refer to
RO/RO	Roll on/roll off ship
RVTS	Regional Vessel Traffic Services
SAR	Search and Rescue
SMT	Shipboard Management Team
SOC	Ship Operation Centre
SOLAS	International Convention on Safety of Life at Sea
SOT	Ship Operation Team
STCW	International Convention on Standards of Training Certification and Watchkeeping for Seafarers
TEU	Twenty foot equivalent unit. Technique of quantifying ISO containers i.e. 1 x 20ft = 1 TEU; 1 x 40ft = 2 TEU.
VDU	Visual Display Unit
VHF	Very High Frequency
VLCC	Very large crude carrier
VTS	Vessel Traffic Service System
VTMS	Vessel Traffic Management System
ULCC	Ultra large crude carrier
UMS	Unmanned Machinery Space
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
USD	U.S. Dollar
USEC	United States East Coast
USWC	United States West Coast
WNU	The World Maritime University

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PART I

MAJOR INFLUENCING TRENDS

CHAPTER 1

WORLD TRADE AND SHIPPING IN THE 1990S -- GENERAL SITUATION

The world has been changing! For better? For worse? In the long run? In the near future? As the 1990s is approaching, numerous analyses, forecasts and predictions are being done, especially in the fields of trade and economies. However, due to the strong fluctuations of the world economy during the 70s and the present 80s, which have exerted shocking influences on the world shipping and the shipping world, all the predictions and forecasts are done with more care, more reservations and less publicity.

Nevertheless, to prepare for the near future, it is always helpful to review the past performance and check its present status while analysing potential influencing factors. The first chapter of this paper will be devoted to brief discussions of the following factors:

- trade volume
- changes in industry and trading structures
- distance and trading routes
- port operations
- other modes of transportation
- international conventions and national regulations
- demands for shipping and ships

I. TRADE VOLUME

The last ten or more years have seen the world economy experiencing a slow development period and fundamental structural changes. The trade volume has shown an average annual increasing of 2.94% (calculated based on the statistical data collected and published in World Trade Review and Outlook from 1976 to 1987). By the year 1995 the world trade volume will increase to around 140% of the year 1980 and about 160% by the year 2000. (Fig.1.1)

This trend can also be further guaranteed by the other factors such as growth of the population, which quite probably will continue to increase at the current frightening rate to about 6 billion by the year 2000 compared with today's 4 billion, generating enormous demands for everything. More than likely this promises a greater rate of increase in world trade volume as a whole.

A more optimistic forecast is advocated by D. Stonebridge, Director of Drewry Shipping Consultants Ltd, when he stated in early 1987, "...The various forecasts of the volumes to be handled quote figures such as 10,000 million tonnes by the year

2000 with the current volume of just under 4,000 million tonnes."

While trade volume is a vital indicator of trends, we must also study other factors which may play some decisive role in the future.

To mention but a few:

II. CHANGES IN INDUSTRY AND TRADING STRUCTURES

A. The advancement of Information and Technology Flow

The increase of the availability and the reduction of the cost of information regarding its sources and market and technology development is one of the characteristics of the 1980s. This, in one way, doubtlessly contributes a lot to facilitating and speeding up the trade flow, while in another way, it does substitute for the shipment of goods when the transfer of technologies are done more and more in forms of "software" than hardware, e.g. data centers and networks, EDP systems, academic forums, seminars, training, consultancy, etc., which are reducing the level of international trade in an invisible way. As we are moving more and more towards an Information Society, this trend is gaining more force and will have more influence.

B. Multinationalism

As a form of modern industry, multinational enterprises have become a common scene to compose comparative advantage and to take advantage of vertical and horizontal economies of scale and benefits from enjoying near monopoly status. Although no precise data has been developed, it is clear that this form of industry has come to account for a greatly increased share of the world trade, with increased ability to export/transfer technology, capital and supervisory personnel backed up by a tenfold increase in all forms of communication. Whether it is taking place among industrial countries or spreading to newly industrialized countries and developing countries or the other way round, this trend does influence the world trade in two ways' i.e.

- 1) Promoting - when taking the form of re-export; and
- 2) Substituting - when producing and selling in the same or nearby region.

C. Structural Changes of the World Industries

Thanks to the popularization of the technologies and the drive of developing countries towards industrialization, traditional industrial countries are losing their dominating power or even competitiveness in some medium-technology products because of their comparative disadvantage in resources and/or labour costs. The growing share of the developing countries in textile industries, machine-building and electronics industries, etc., and even in shipping and shipbuilding industries are quite self-evident and self-explanatory.

Responding to this, the industrial countries are trying to keep their competitive edge and market share and to remain ahead by moving more and more towards high-tech fields in addition to their advanced management and productive efficiency.

These changes and developments are not only influencing considerably the international trading patterns in cargo flow directions, in cargo volumes, in tonmiles and in unit values but also in shifting the center of gravity of the world economy as a whole. The 1990s will no doubt bring more of the changes.

D. Cost-cutting Changes

Owing to depressingly long periods in the slow growth of the world economy, the reducing of the gap of technology among countries and thus more severe competition as well as the overcapacity in many industries worldwide, e.g. OECD countries are running their production at 3/4 of their real capacity - greater stress has been laid on cost-reducing changes rather than on the satisfaction of new wants. This shift of emphasis in the 1980s has resulted in some way in the reduction in both the international trade and direct investment, which, in turn, is worsening the whole situation, except that these efforts are pushing the unit productivity and industries management to a higher level, which benefits the world in the long run.

III. SEABORNE TRADE

We can observe from the Fig 1.1 that the seaborne trade curve does not go along proportionally in parallel with the trade volume curve, since it is dependent on more variables, active and sensitive, either in terms of volume or tonmileage.

Fig. 1.2 illustrates the development of the world seaborne trade volumes and tonmiles from 1974 to 1986 and is drawn according to the statistic data published on Shipping Statistics Yearbook 1986 by ISL/LSE (BR 3.2). From which the following can be observed:

1. The coefficient of tonmiles against tonnes is getting smaller gradually and continuously since the re-opening of the Suez Canal in the year 1976:

EXTRAPOLATION OF THE VOLUME OF WORLD TRADE (1987 - 2000) Fig. 1.1

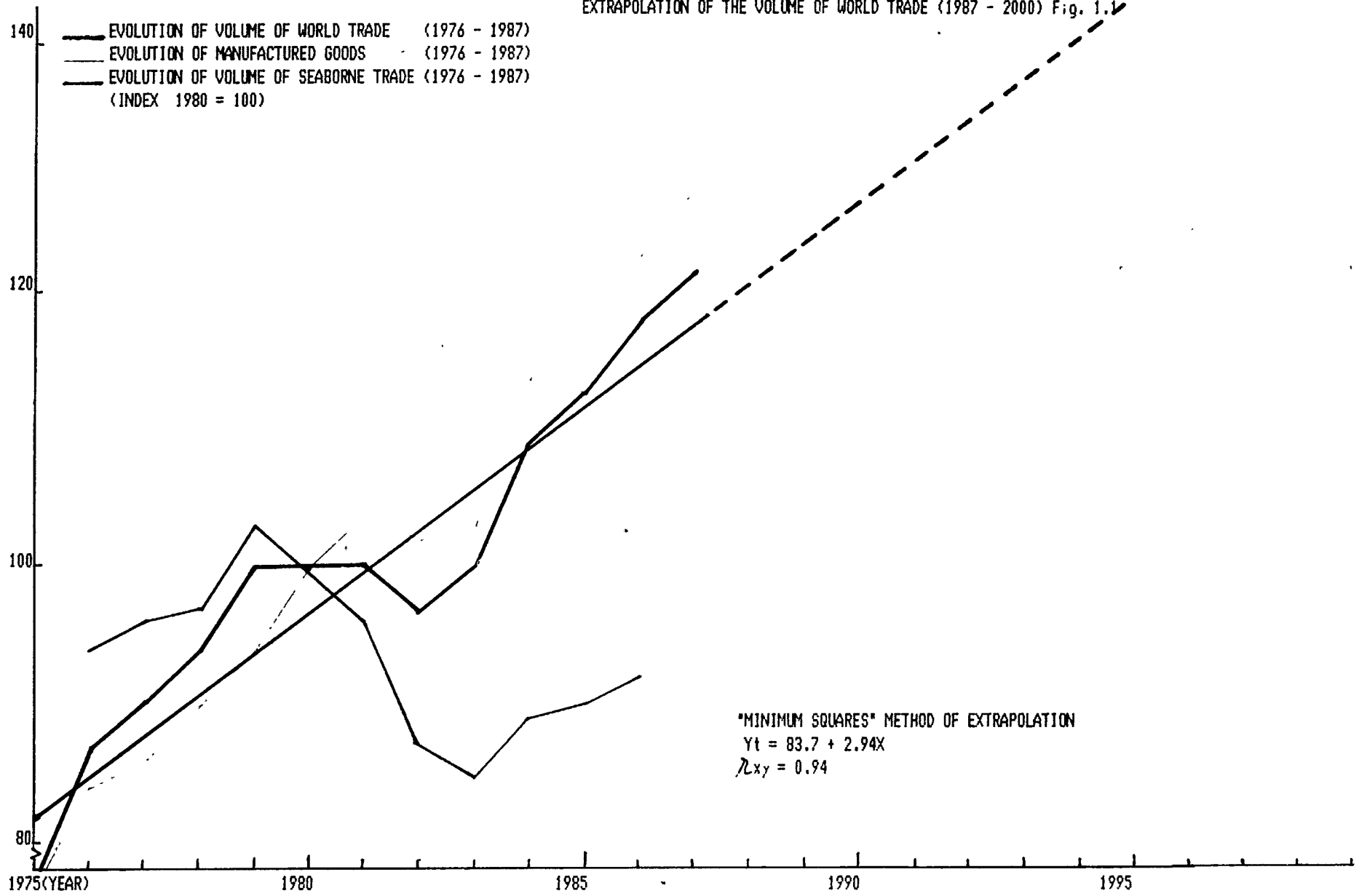


Fig. 1.2 RECENT EVOLUTION AND FUTURE TRENDS OF THE WORLD SEABORNE TRADE

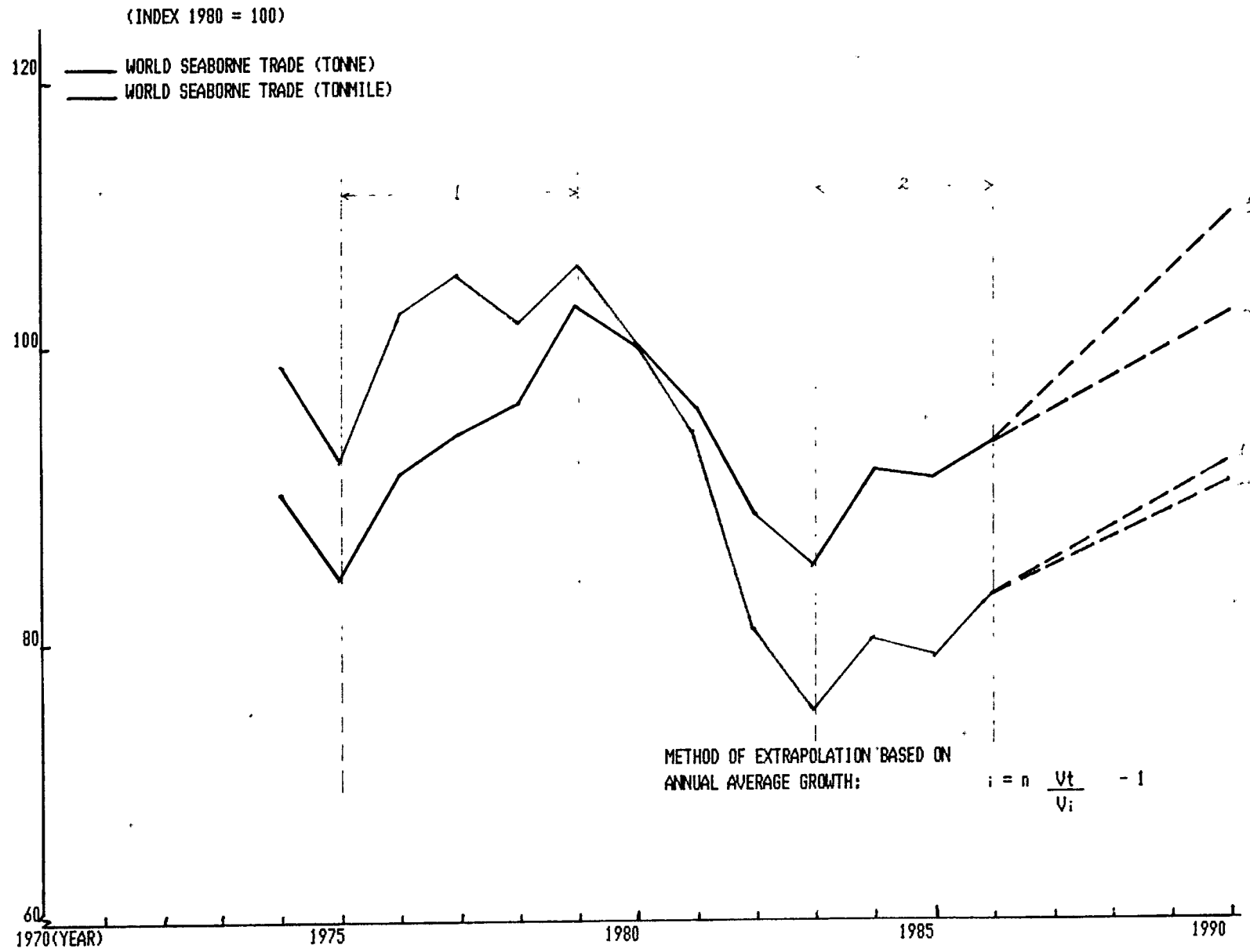


Table 1.1 The Coefficient of Tonmiles Against Tonnes in the World Seaborne Trade

Year	Total	Crude oil
1974	5.04	7.10
1975	5.04	7.03
1976	5.13	7.23
1977	4.89	7.17
1978	4.72	6.68
1979	4.72	6.31
1980	4.34	6.23
1981	4.53	6.15
1982	4.22	5.24
1983	4.07	4.82
1984	4.04	4.68
1985	4.09	4.75

This reduction is mainly due to geographical changes affecting the supply side, especially in crude oil sector as a result of the worldwide large scale offshore oil exploration in recent years, which has shortened the geographic distance between the supply and demand locations.

2. The drastic downward trend of the seaborne trade from 1970 to 1983 mainly resulted from the second oil shock when OPEC countries doubled the oil price for the second time. The fact is that the annual percentage of reduction of oil trade was higher than the reduction percentage of the seaborne trade as a whole.

However, what is more important is that the successive reduction during this short period reveals the increase in the demand elasticity of this commodity. Coupled with another fact that the share of the OPEC crude oil production has been lessened from 11252.1 million barrels or more than 50% in 1976 to 5847.6 million barrels or 28.1% in 1984, and exporting via sea routes is reduced from more than 80% in 1974 to around 60% in 1984, the future possibility of the price shock is therefore greatly reduced. The significant reduction of the crude oil price in 1986 was another indication. Various analyses and forecasts collected and summarized in ISL August 1986 show a similar prediction that crude oil prices will be comparatively stable, and energy demand prospects are in the range of 0-2.4% p.a., until the year 2000.

Another important factor that causes the reduction of the seaborne trade volume of crude oil is, in addition to the substitution commodity, the substitution of the mode of transportation--pipeline traffic. As an effective means of liquid cargo transportation, more and more oil pipelines have been and are being set up as long as the geographical and geological conditions fit. (Annex 1: A list of the major projects.

Apart from liquid cargoes, pipeline transportation is also being considered to be applied to some solid cargoes like coal or tincans by mixing the cargoes in water or slurry to make

them flowable through pipelines.

3. Apart from the development in pipeline traffic, rapid growth of other modes of transportation, i.e. air, road and rail also act as a substitute for a considerable amount of seaborne traffic.

Air traffic will doubtlessly take more and more high-value cargoes following the development of the high-tech industry. The trend of size and weight reduction of the products as well as the demand for shorter transportation time is a growing phenomenon in our modern society.

Road and rail modes are playing a more and more important role in the modern transportation network, e.g. container traffic and door-to-door service, especially the development of the land bridges and minibridges in recent years. These land bridges do serve as efficient links along the whole transport chain and shortens the distance and time of transportation, while in another way they take away a growing amount of cargo from the previous searoutes. For instance:

The Trans-Siberian Land Bridge conveys presently more than 2,000 containers per month from Europe via Nakhodka and Vladivostok (eastern ports of USSR) to Far East. The newly introduced economic reformation and the future economic development in the Far East area will quite possibly motivate more use of this traffic.

The US Land Bridges which links USEC and USWC ports is mainly used for containers moving between Europe and Japan. This route reduces the sea transit time by 7 to 12 days compared to the all-water route via the Panama Canal. And it is also used as a minibridge for cargoes from Europe destined for the USWC and from Japan for the USEC.

Therefore, it is very difficult, if not impossible, to predict the future seaborne trade. Even if we exclude the political and climatical factors, which are nearly unpredictable but may be the more decisive influences in many cases. Nevertheless, it is still very useful to find the trend, based on the available statistical data of the past performances, as an indicator. From the data given in Fig. 1.2, we can divide the past twelve years into three periods:

1. 1975-1979, normal development, 4.04% p.a. in volume and 2.65% in tonnemile;
2. 1979-1983, recession period, which does not seem to repeat again in short run because of reasons discussed above (Observation 1). Therefore it is justifiable to exclude this period when forecasting the future normal development.
3. 1983-1986, normal but low development, 2.25% p.a. in volume and 2.37% in tonnemile.

The development rate of 2.65-4.04% p.a. in short and medium term is also seen predicated in the review presented in the Baltic Shipping Gazette 3/86.

IV. SUPPLY SIDE: SHIPS AND SHIPPING

1. General Situation

The 1970s witnessed fundamental changes in the organization and structure of international shipping. The total fleet doubled during the years 1968 to 1977 with an average expansion rate of 7.2% p.a., adding huge amounts of overtonnage and has to great extent worsened and prolonged the recession in the shipping sector since the economic crisis came in in late 70s.

Laid up tonnage peaked its historical record of nearly 100 million dwt in 1983, representing only 1/3 of the overtonnage, the other 2/3 of which was absorbed in daily fleet operation, namely, slow steaming and dead freight in space utilization.

Scrapping was accelerated. A total of 9156 ships of 90,301.866 GT were broken up from 1979 to 1985. Together with ships totally lost, 11,743 ships of 102,664,094 GT were seen drawn out of the world fleet, with still over 60 million DWT laying up. The situation has relaxed a little since. The first quarter of 1987 saw the laid-up tonnage reduced to around 25 million DWT (RB 3.1.; 2.9 1/87).

Will equilibrium be attained in this decade, or in the 1990s? If it is finally achieved, on which level will it be and how long can it remain? The answer is not so optimistic. This is to be discussed in terms of:

- total turnaround time
- shipbuilding cycle
- fleet structure: size, number and technology employed

2. Port Operation

As a service sector for ships, ports worldwide have undergone some important structural, organizational, operational and even conceptual changes to adjust their activities to the changes which took place in shipping sector. These includes:

- New port design,
- new technology,
- new warehousing and stacking systems,
- modern cargo handling equipment,
- terminal specialization,
- EDP# (electronic data processing) port operating systems,
- VTS# (vessel traffic service) systems,
- simplified documentary systems and
- improved hinterland links,
- etc., which took place in ships and shipping practices. They have succeeded in reducing tremendously ships port time, particularly in the ports of OECD countries.

Port congestion has long disappeared from most ports in the industrialised countries and are gradually disappearing in the congested ports elsewhere with fast development and rationalization of these ports.

In Europe, all ports are now suffering from overcapacity. Competition is escalating. They are trying with great efforts to attract more ships by providing better and more efficient services and increasing operational flexibility (e.g. the

strategies and practices of Weekend Port., Free Port, Cargo warehousing and distributing function and Harbour Complex, etc.). All these have resulted in further facilitation of cargo flow and reduction of ships port time.

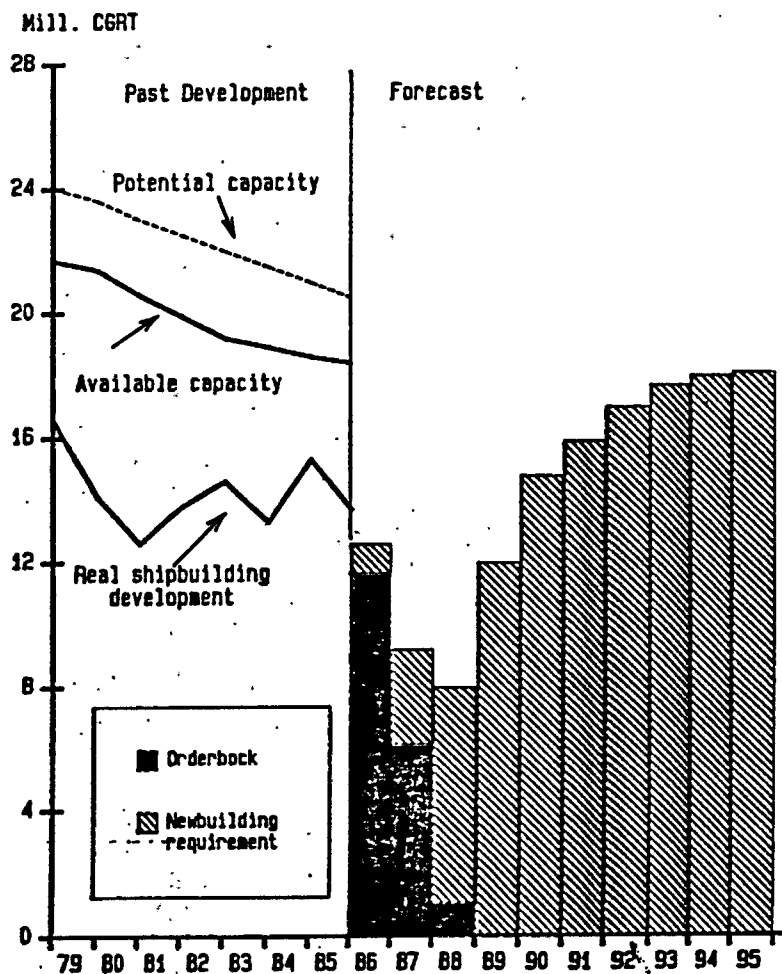
In the Cargo sector, the unitization of general cargo, i.e. containerising, palletising, presling, LASH, etc., plus later developed RO/RO has made it possible and indeed pressed a much faster and more efficient cargo handling to enable faster turn-round time and modern logistic system employed.

Bulk cargo handling has been and will be more mechanised and liquid cargo pipingised. The port time is and will be counted by hours.

All this means that fewer number of ships will be needed to fulfil more voyages annually.

3. Shipbuilding Performance

The cut-throat competition in the shipbuilding industry started in the 1970s and aggravated in the 1980s almost squeezed the traditional West European shipbuilding industry out of existence (from over 70% of the market in the 50s to only 16%, representing 13.4% of ships of 2,000 tonnes and above, in 1985). About 10 million CGRT were cut out (from 28m, 1979 to around 18m, 1985), still the whole industry is suffering from huge over-capacity, almost by half, in 1987 and 1988, according to ISL forecast (Fig. 1.3).



Yards are competing for new orders by cutting their prices, increasing quality, providing varieties and reducing building time. Delivery time have been shortened to 3 to 12 months. Still the number of ships on order dropped below the 1000 mark, to 946 of 29,778,685DWT April, 1987 compared with 2,677 of 145,625,277DWT in April 1976 (RB 2.11. 4/87).

4. World Fleet Operation

Shipping and shipbuilding industries have been exposed to violent changes and experienced severe cyclical plus structural crisis for more than ten years. They are, in many ways, getting accustomed to an existence with turbulent external and internal conditions.

Struggling through the strong turbulence during these years, the present world fleet is gradually approaching or adjusting to optimum ship size and operating speed in all sectors to exploit economies of scale in both ship and port operation as well as in shipbuilding, e.g. Sister Ship Orders. This trend will go further, and to the detailed number of ships operating on specific route and trade for most individual ship operators, according to the gradually increased loading factors and shortened trip time, mainly from the reduction of the port time.

Present new orders up to mid 1990s are and will be mainly for the replacement of obsolete tonnage and the needs of specific new trade/s. Ordering will be done with care, taking into considerations all foreseeable future requirements, such as;

- type and size,
- hull and machinery,
- navigation instruments and cargo gears,
- fuel consumption and paints,
- automation level and hotel arrangement,
- plus existing national and international regulations and the ones to be in force, etc.,

while the shipbuilding industry is adjusting more than quickly to all the possible demands thereof derived. So is the port operation.

The 1990s will undoubtedly see a comparatively smaller but more efficient fleet of higher technology running along to meet the trade development.

What will be the fleet size of the future? This is hard to predict, even roughly. If we limit the present merchant fleet to 10,000GT and above which are less than 14 years of age, calculated according to the data given in Lloyd's Register of Shipping Statistical Table (1986), by the end of 1986 we had:

Table 1.2

TYPE	NUMBER	GROSS TONNAGE
Oil Tankers*	1,846	103,794,309
% of the group	47.6%	96.9%
Ore & Bulk Carriers **	3,661	101,851,800
% of the group	95.0%	98.4%
LNG & LPG	178	12,388,783
% of the group	35.0%	93.7%
Fully Cellular Containers and Lighter Carriers	540	15,053,784
% of the group	63.7%	90.3%
Others	1,927	17,820,944
All Ships	8,152	250,709,620
% of the group	20.1%	82.5%
% of the size group	74.3%	74.1%
All Ships of 10,000GT & over	10,970	338,472,367
% of the World Fleet	14.6%	83.6%
World Fleet (All sizes & ages)	75,266	404,910,267

* including combined oil/chemical tankers

** including combined OBO carriers

*** According to ISL/LSE, general cargo fleet of the above defined size and age group is 2,001 (Jan., 1986), 52.8% and 27,833,700 DWT, 48.8% out of the size group.

From this table, we can see that ships of 10,000GT are representing about 84% of the total gross tonnage and 80% of DWT (1985 data by ISL/LSE). If they can be considered comprising the medium and long sea international trading fleet, more than 70% of which will still be seen trading by the mid 1990s. Over 5,000 of them (over 40%) will still be in service up to the year 2000 if we see the average service life as 15 to 20 years in the next decade.

Since the fleet growth stagnation started in 1979 due to the heavy overtonnage, the fleet development have followed an adverse trend and has been negative since 1983. It is generally believed that this gloomy trend will continue, at most go level, until 1995 or later, due to the overcapacity in all sectors, which exceeds the possible increase of the trade volume. Do not forget by the end of 1985, a trade booming year, the overtonnage still accounted for 25-30%.

Even the new tonnage replacement will surely see the reduced number of ships compared with the tonnage, especially in the

general cargo sector, when up to 1995 about 50%, and about 70% by the year 2000, of the existing fleet will probably be replaced by container vessels with much larger unit carrying capacity and more than 10 times less port turn-round time.

So it is evident enough that first part of the 1990s will see a less number but more advanced ships serving on international trading routes. (The future ship technology will be discussed in later chapters.)

Assuming that the comparative equilibrium between demand and supply of all sectors will finally in vicinity and the world economy enters faster growing period as expected, at the second half of the 1990s, will the shipping world react more rationally than before?

Too many people have been waiting in pain for too long! They will naturally over react, forgetting their previous collective mistakes. Despite the fact that the prolonged industry crisis may have shuddered their confidence, eventually the market will once more be depressed by severe competition from newly built overtonnage.

Hopefully, the prudent bankers' reluctance in repeating the mistakes of overgenerous financing may buffer the over ordering. The question is that: will the new generation of bankers behave more prudently in this exciting business when facing a positive trend?

CHAPTER 2

STRATEGIES OR POLICIES BEING EMPLOYED & THEIR INFLUENCES ON DEMAND FOR MARITIME EDUCATION AND TRAINING (MET)

The quantitative and qualitative demand for MET internationally and nationally is the ultimate concern of this paper. In this chapter, strategies and policies that are being employed and their corresponding influences on demand will be briefly discussed. This will be done mainly in the context of those traditional maritime countries.

I. STRUCTURE OF TRANSPORTATION

1. Vertical Development

The 20th Century has experienced four stages of evolution in transport structure and policy (BR 4.9)

- the Railway Age: (1880s-1920s)
- the Age of Protection: (WWI-1945)
- the Age of Administrative Planning (mid 1930s - mid 1970s)
- the Age of Contestability (1960s-present and future)
(deregulation and decentralization)

The 3 periods of structural change cover :

- (1) the decline of the railway and the rise of bus and car;
- (2) the consolidation of regulation and the expansion of state control i.e. free market philosophy vs government protectionism;
- (3) the breakdown of state control and the rise of disengagement.

Most parts of the present world are subject to the domain of the Age of Contestability.

The key organising principles underpinning this age are deregulation and the reassertion of the application of allocative efficiency in transport and transport policy. Barriers to free entry and exit from any market are being reduced by technology innovations and popularization. Easier entry and exit from shipping market is a good example. Markets and future are choosing the most efficient to be the major players.

2. Horizontal Development

The rapid development of information, communications and transportation is bringing the different parts of the world closer together. Every sector is expanding, linking more rhythmically with other sectors and becoming more one of indispensable components of whole globe picture. Interdependence grows together with competition, completing the network of the whole system. The same issue has also been discussed in IV-2, Chapter 1 from another angle and will be further illustrated from other angles in Section II. It is therefore not surprising to see that the newly developed EEC Shipping Policy is

in fact more in the name of transportation policy, i.e. Progress Towards a Common Transport Policy - Maritime Transport (COM(85)90) (Ref. RB 4.8)

The inter-penetration and inter-expansion of all modes of transport plus natural competition stemming therefrom are generating a greater need and more opportunities for various expertise in all the inter-related sectors (mainly shore-based). This demands for a wider knowledge structure and rational concept built up with the help of education. This is the stand from where we see and foresee a part of quantitative and qualitative demands for MET throughout the world.

II. INTERNATIONALIZATION AND REGIONAL CO-OPERATION

1. International Regulation of the Transportation Network

Being a part of whole development, internationalization also shows a increasing trend in a funny conjunction with the trend of national deregulation and decentralization.

As mentioned above, the trend towards greater intra-industry specialization expands the intra-industry trade, e.g. car and electronic products manufactures. Larger volumes of various component units flow across national borders in all modes or, more to the case, multi-modes of transportation. More and more industries keep their stock in the constant flow of transportation to minimize tied-up capital. A more system-oriented transporting/distributing operation with higher efficiency becomes one of the influencing factors for total industrial productivity.

Integrated transportation systems, nationwide, regionwide even worldwide have been talked about for many years. The total system concept is gradually built up and developed, which in turn demands painful foregoing abandon of the traditionally separated sectors and equally painstaking effort for intermodal co-operation and co-ordination. A good spirit of international co-operation and co-ordination is vital, with the essential input of international communications and logistic systems from the technical sector and with identical international or regional regulations with less bureaucracy from the administration part. This is where the future lies.

We have already seen the unbroken flow of commodities across borders and seas via more than one or two modes of transport all over Europe in all directions - North, East, South and West as well as other industrial continents. We will see this developing throughout the rest of the world, too.

2. Internationalization of the Shipping Industry

This is not a new subject. Shipping is international by nature. However, the recent and future trend is to move beyond the traditional concepts towards more internationalization in day to day operations, reflecting the policies or strategies being developed.

The concepts of cost-effectiveness and free competition on a

worldwide basis, have encouraged the trend to such a degree that nationalities are chosen mainly on cost advantage considerations. This is true from ship financing, building, registration and ownership on to ship-operating, chartering, trading and manning! This most evident in the choice of flags and in manning practices, which have become a hotly-debated issue since WWII and becomes more acrimonious as time passes. These debates and their implications for maritime education and training (MET) are to be taken up later.

III. GOVERNMENTAL AND INDUSTRIAL PROTECTIONISM

As long as there exist conflicts of interests and competition, there will be some forms of protectionism.

When passive protections of subsidies are less provocative, active protections like cargo reservation and flag discrimination are still favourably practised in many parts of the world.

The accessibility to cargo is always the focal point for fleet space utilization, especially when overtonnage is pressing. Cabotage, EEC common policy, UNCTAD Code of Conduct for cargo sharing, socialist countries' "National cargo on national bottom by national crew" and the growing number of bilateral or multilateral agreements for carriage of the trade, etc.- all will naturally set the trend for the 1990s and on into the 21st Century. Another trend is the contracting of the tramp market, which is to be further illustrated in Section IV below.

In the next section when the choice of flags is discussed, we will see another interesting form of protection for keeping national fleets under the national flag or at least under the nation's control. That is the establishing of international registries in the industrialized countries, or in their dependencies to respond to the overwhelming trend of flagging out.

IV. CHOICE OF FLAGS

(Ref. RB 4.10, 2.7 6/87, 2.12 1/81, etc.)

During the past three decades, open registry tonnage has been steadily rising from around 41 mn GRT, 18.5% of the world fleet in 1970, to 116 mn GRT of 26.7% in 1980; and goes further up to 141mn GRT or 35% of the present world fleet. In addition, the number of registers are rapidly increasing from 6 in 1970s to present 20 (Data available upto April, 1987). International ship registration has gradually become an industry in its own right, with open registers marketing and competing for services to the shipowning community around the world.

The voice of UNCTAD and ITF to phase out this open registry is being muffled and ignored and is gradually tuning to protect the jobs, wages, living and working conditions of the seafarers working on board the FOC vessels. This does not mean that they have tried less. The trend is far too overwhelming, especially at present stage when shipowners, pressed by the prolonged recession and very low freight market, are trying by all means to cut costs to the bone so as to maximize profits and somehow survive the crisis. ISF even prepares and constantly renews a book of guidance called, GUIDE TO INTERNATIONAL SHIP REGISTERS (RB 4.10) to give shipowners some practical help to choose "the right flag to fly".

For shipowners, particularly those of high-cost and high-income countries, the advantages of flagging out are obvious, namely:

- (1) Easy access to the registry and easy transfer from the registry at the owner's option;
- (2) Taxes on income from the ships are not levied locally or are low. A guarantee or acceptable understanding regarding future freedom from taxation may also be given; (This factor is more important for profit-maximization than cost cutting in manning for some high-wage and high taxation countries.)
- (3) Cheaper registry fee and annual fee (See Table 2.1 & 2.2), with possible waivers and discounts, e.g. Bermuda offers volume discounts of 50% for the second or subsequent ship under the same owner or management; Bahamian registry even offers a sovereignty waiver to the owner's government control in time of war or emergency; etc.;

Flag	ANNUAL TONNAGE FEES (\$000/year)		VLCC (255,000dwt)	REGISTRATION COSTS AND ANNUAL FEES INCURRED OVER TWO YEARS (\$000)		
	21,000 dwt	89,000 dwt		Flag	89,000 dwt	VLCC (255,000dwt)
Cyprus	2.7	6.3	9.9	Isle of Man	0.3	0.3
Malta	2.6	10.4	30.6	Cyprus	16.2	26.9
Liberia				Malta	27.8	81.9
— established owner	2.5	11.9	30.0	Liberia		
— newcomer	3.3	13.4	39.5	— established owner	47.8	111.7
Bahamas	1.8	4.6	11.8	— newcomer	63.0	177.6
				Vanuatu	40.2	118.4
				Bahamas	46.0	132.1

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(4) Manning of ships by non-nationals is freely permitted, even unduly certificated; (Another major source of cost-saving for shipowners) (Ref. Table 2.3 from the same source above.)

Flag	Vessel age restrictions	MAIN REQUIREMENTS ON REGISTRATION FOR SELECTED FLAGS					Manning
		Classification Societies authorised to survey and issue certificates	Dual or parallel registration	Nationality Restrictions and Ownership	Restrictions and Requirements Management		
Isle of Man	None	ABS, BV, DNV, GL, LR	No	British/Commonwealth citizen resident on IOM or IOM incorporated company	Isle of Man based	UK, Eire or Commonwealth certificates	
Cyprus	<17 (older vessels subject to stricter management/ownership requirements)	ABS, BV, DNV, GL, HRS, LR, NKK, PRS, RIN, RNR	Permitted by bareboat charter	At least 50% by Cypriots or by local registered company	None	Minimum of 15% must be Cypriots, if available	
Malta	None	ABS, BV, DNV, GL, HRS, LR, NKK, RIN	No	Maltese citizens or body corporate	None	None	
Liberia	<20 (also <25 subject to limited exceptions)	ABS, BV, DNV, GL, LR, NKK	Permitted	Liberian citizen or corporation	None	None	
Vanuatu	<20 (may be waived in exceptional cases)	ABS, BV, DNV, GL, LR, NKK	Permitted by bareboat charter	Citizens or Vanuatu corporation	None	None	
Bahamas	<12 (older vessels with ministerial permission on certain conditions)	ABS, BV, DNV, GL, LR, NKK	Permitted by bareboat charter	Foreign ownership permitted	None	None	
Bermuda	None	ABS, BV, DNV, GL, LR	No	British subjects or bodies corporate established under H.M. Dominion laws	None	Certificates of UK or certain Commonwealth countries	
St. Vincent	<40	ABS, BV, DNV, GL, HRS, JRB, KRS, LR, NKK, RIN	Permitted	None, but must have registered local agent	None	None	

NOTES: ABS — American Bureau of Shipping; BV — Bureau Veritas; DNV — Det Norske Veritas; GL — Germanischer Lloyd; HRS — Hellenic Register of Shipping; LR — Lloyd's Register of Shipping; NKK — Nippon Kaiji Kyokai; JRB — Jugoslavenski Registar Brodara; KRS — Korean Register of Shipping; RIN — Registro Italiano Navale; PNR — Registrul Naval Român.

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(5) Less restriction on ship's age (Ref. Table 2.3.)

(6) Subject to less or no commitment to national legislations or regulations nor to that of the registers thus having more flexibility in trading areas, in equipping the vessel, mainly on safe equipment, e.g. a German shipowner will have to invest around DM 2,000,000 more on a German flag ship to meet the FRG national requirements for life saving appliances other than the minimum requirements stipulated in IMO conventions.

No wonder that the trend of flagging out is accelerating! However, this in turn is shaking the shipping industry as a whole in the traditional maritime countries and is gaining the attention of their governments and all the related sectors.

and the prospect of worse to come (Ref. Fig. 2.1), the Labour government, following the lead of its predecessor, laid a Government Bill before the Parliament on 10 April, 1987, proposing the establishment of a second ships' register - the Norwegian International Ship Register (NIS). Despite the strong opposition from the unions and doubts from shipowners, NIS is in operation from 1 July, 1987. It is designed to attract back the flagged-out tonnage and other non-Norwegian tonnage through large-scale liberalization of existing rules and regulations. For instance:

- no nationality requirements on manning (but will try to encourage owners to keep a core of native officers);
- no nationality requirements on equity capital;
- vessels on the registry to be able to apply Norway's new manning regulations which came into effect on 17 March, 1987, and enable reductions in manning levels;
- foreign owners to be granted partial exemption from Norwegian taxation;
- foreign seamen to be exempt from income tax;
- the owners to be able to enter into collective or individual agreements with the seamen, or with organisations representing them;
- as a non-profit operation, the registration fees to be determined by the costs of the maritime administration only;
- etc.

The specific aim of all this is to make the registry fully competitive with the open registries in terms of operational costs, and is intended to encourage renewed growth in the Norwegian-flag fleet. The effect is so far promising with already 300 ships registered back, and the number is expected to reach 1000 before the end of this decade.

In the U.K. the trend of flagging out has followed a similar gloomy pattern. Two thirds of their tonnage was lost in the last ten years and is still continuing. Nevertheless a large percentage of so called foreign-flag ships are registered under the flags which are covered by the big umbrella of British Register including the UK, the Cayman Islands, the Isle of Man, Hong Kong, Gibraltar, Bermuda and Turks and Caicos Island. Most of these are considered to be FOC by ITF. Even the ones which are not considered to be FOC, are offering quite favourable conditions to shipowners in all respects. (Ref. Table 2.1, 2.2, 2.3 and RB 4.10)

In France, the Government announced in June 1986 its permission for French bulk carrier owners to register their ships in the French Antarctic territory of the Kerguelen Islands where French labour legislation does not apply. This register permits greater flexibility in terms of crew nationality with a requirement for minimum 25% French crew and at least 4 French officers among them.

As in Norway and the UK this decree of permission was immediately opposed by the unions and was the partial cause for a month-long strike. Nevertheless, the French Government has pressed ahead with establishment of the register, including it in its merchant shipping plan published in March, 1987. At the end of 1986, 12 ships of 569170 DWT had been transferred and another 18 vessels will during 1987, as is estimated.

Another case, the Luxembourg Register is also being planned and is aimed at attracting high-cost European owners. If approved, it will come into being in 1988. The registration fees will be set significantly below those of the major European registers and with a large degree of flexibility in terms of crew nationality requirements. Safety requirements will not be slackened, of course.

Finland and Denmark as well as other countries are also considering the similar measures.

So, the trend is clear. In the 1990s more than 50% of the world fleet will be registered under all forms of international open registry, enlarging the market for low-cost seafarers of higher quality.

V. TECHNOLOGY DEVELOPMENT VS MANNING SCALE

Transportation is usually considered as a major industry in itself providing employment for millions of people throughout the world. So had been shipping, but it is no longer the case today. The cut-throat competition in the low market (or "new market situation" - returning to days of old - as some people believe) and rapid increase in labour cost (e.g. over 10% in 1987 in Norway) plus inflation have driven shipowners of these high-cost countries to rely more on newly developed technology, especially automation, to reduce manning cost. The result or the trend is that more and deeper studies and experiments on lower and smaller manning levels have been carried out; shipowners or operators waste no time in putting them into practice and the governments, who usually are the research sponsors, quickly adjust their regulations concerning manning levels to meet industry specifications. (Ref. Manning Regulations of Norway, Japan, USA, etc.)

The following is a list of demanning experiments and practice carried out in some countries:

Table 2.3.

Norway	16-21	on board large oceangoing vessels
	13	on certain ships
Greek	15-17	on a multipurpose carrier*
	16	on a 25,000T bulk carrier
Japan	18	a research project on 14 ships
	18	on board container ships
	17	a new project
	12 & 7	on board container ships*
West Germany	18	on board container ships
	12	"Ship of the Future" Project
Sweden	16-20	on a 22,000GRT RO/RO vessel
Netherlands	22	*on a multipurpose carrier and a 30,000T product carrier
Belgium	15-17	
USA	15-17	

(* = experiment stage)

The list has excluded, for practical reason the trying for unmanned ships since this will be no more than an experiment in some specific environment before the end of this century. Technically, it is already possible, whereas economically and commercially it does not pay and no one is ready to pay. So far, it has already been proven that the least possible "minimum safe manning" is six, for specified conditions and required qualifications, excluding the consideration of cost effectiveness and availability of these highly qualified personnel. This study is done by Det Norske Veritas, with the following manning specifications of the feasible ship with specific standards:

- Watch-1
- EO
- Maintenance-0
- ICS (Integrated shipboard Computer System)

- Mooring-1
- Cargo-1

The corresponding manning scale:

- 3 Watch officers
- 2 Machinery/automation engineers
- 1 "Multipurpose" person (just to illustrate this: He should have technical background and catering abilities and would also assist in mooring operations, etc.)

This is just an extreme case introduced here as food for thought only. Also, it has so far been concluded as not to be cost effective and remains theoretically possible only.

The major technical considerations and a brief description of many related projects will be discussed in next chapter. At this point, only the cost-effectiveness factor, which is the paramount concern of the shipowners and operators, is to be discussed.

In the recession, cost-minimization is the first priority plus the improvement of quality of service, which is something that has to be done. For shipowners or operators, this has to be achieved against demands for higher standards and an increasing amount of legislation requiring safer and pollution free operation.

As far as ship operating is concerned, it may differ from ship to ship, from voyage to voyage, and the routes/trades the ships are engaged in; even the seasonal, climatic conditions are a subject of consideration. Also the company strategy and country's policies play a decisive role. Here, for the purpose of analysis we consider only the manning costs and the costs of automation plus the possible repair and maintenance work moved ashore as variables when others are assumed stable, not to mention the initial cost-saving of around \$100,000 for reducing one accommodation cabin onboard.

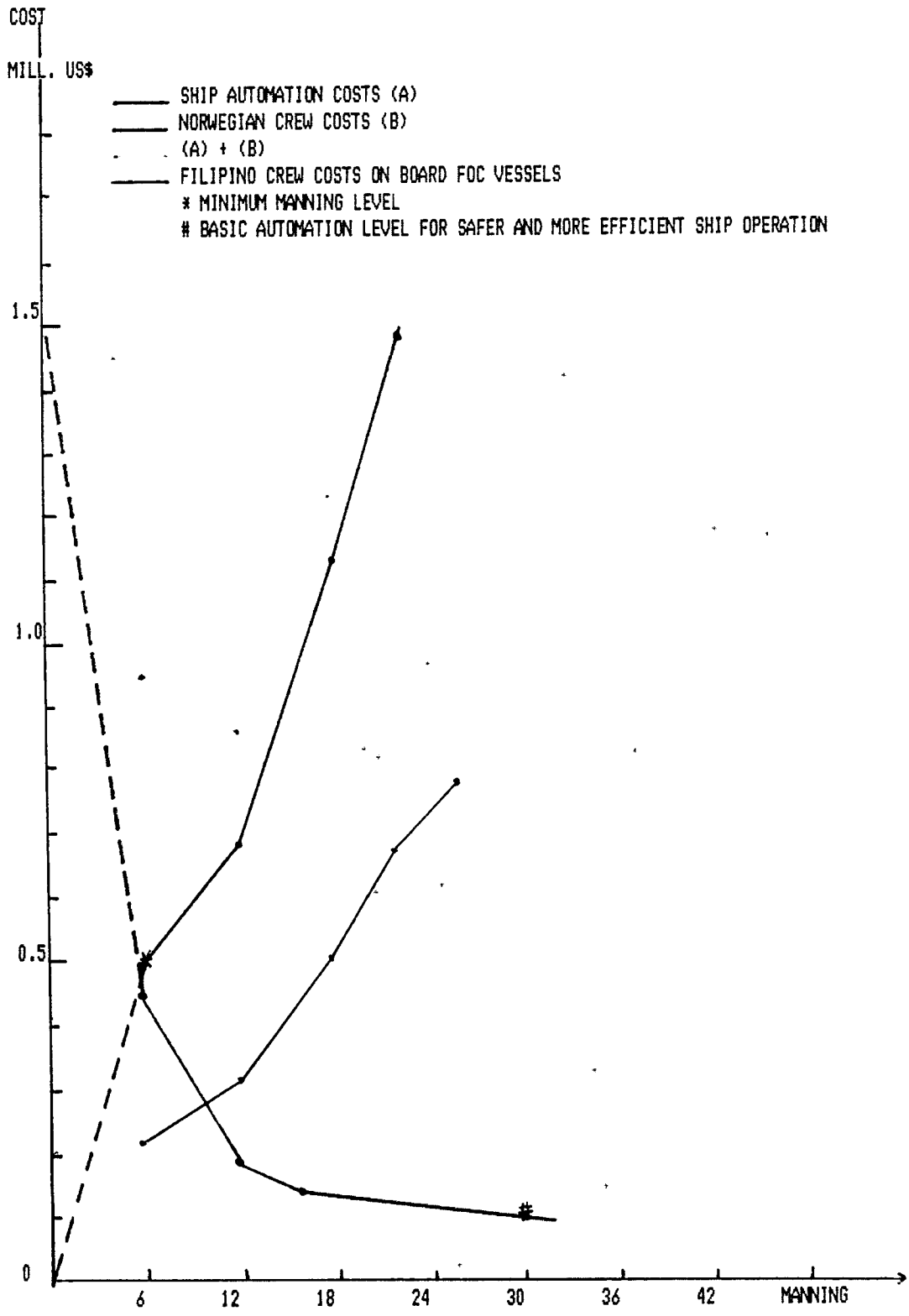
Here, a high-cost country shipowner or operator may have four choices as shown in Fig. 2.4: (except the occasional choices of chartering and second-hand purchasing)

The given conditions: (Figures 1987)

A Far East new building Panamax bulk carrier:

- 61,000DWT, cargo DWT 57,000
- initial cost USD 18 million plus USD 1 million owner's item
- 80% loan on OECD trms, 8.5 year, 8.5%
- 13 knots on 30T/HVO per day and no DO at sea
- fuel costs: HVO USD 110/T, DO USD 180/T
- port and cargo handling per call/port USD 62,250
- 10 days offhire per year
- voyage charters throughout the year at USD 12,38 per cargo ton
- trips 4000 miles one way (8000 miles round trip)
- 32 days including port time
- 6 days port time per round trip, 2T/DO per day
- voyage cost: USD 150,210

Fig. 2.1 COST EFFECTIVENESS OF SHIP AUTOMATION VS MANNING SCALE



Choice A:

If, for some reason, the owner has to retain his national registry and use national crew, then he must consider keeping all his costs down below the breakeven point by investing more on automation (\$100,000 average annual present value) and cut the crew from 22 to 18 (average annual crew cost from US\$ 1,475,000 to 1,132,000 and annual technical operation costs to 420,000;

Choice B:

If he is permitted to flag out and prefer to keep a core of his national crew of 2-10 and the rest are Filipinos with the total crew number of 20, he would have the same automation cost as Choice A and a reduction of operation cost of 30-10%;

Choice C:

If he is permitted to flag out and chooses to use a Filipino crew of 22, then he can further reduce the crew cost to \$657,000, more than 40% net saving from operation cost.

Choice D:

Or maybe he does not have to consider more capital investment on automation but uses more Filipino crew to man his ship and do better repair and maintenance. If he uses 26, as some of the cases in the same company, \$776,500, nearly 40% saving can be achieved compared to Choice A.

Maybe we can even go further to Choice E, another possibility within the preset nationality condition in Choice A:

15 crew of \$960,000 annual cost with a higher level of automation and delegate some of the repair and maintenance ashore, additional cost of, say, \$300,000 net present value annually would add only \$50,000 to the total costs p.a. within the first ten years of the ship's service life and a higher second-hand value.

So far the fully "integrated ship automation system" tried on board "ships of the future" with the crew of 12 have not yet proved to be cost effective nor commonly applicable. The costs for this level of automation plus that of shore repair and maintenance increases geometrically while the reduction of the manning cost is arithmetical. The hope of this scientific research lies in the standardization of all segments of the total shipboard automation system and the sharp fall in cost derived by popularization of the advanced micro-electronic technology in this specific sector as well as the mass production after the standardization, which seems farther away than the popularization of the technology. The total success and final acceptance by the shipping industry is not yet within the medium term range. Nevertheless, no one can really predict the developments of technology and the advents of new innovation. For now, it is better to draw no conclusions yet, at the same time keep an open mind.

However, no matter what may happen in the foreseeable future, from the above group of simplified calculations based on some

reliable figures, it is not difficult to see:

- (1) how big a direct crew cost advantage an owner can enjoy by using low-cost crew;
- (2) how multi-national manning arrangements have given the free flow of technical and operational expertise to all market participants irrespective of national background and thus gradually narrowed or diminished previous gaps in expertise. One can deploy any one of Choice A, B or C with almost same level of manning. It is just a question of trust and control level after the cost consideration;
- (3) Careful choice of optimum cost-effective point crossing the cost of certain level of automation/high technology and the cost of the corresponding type and level of manning is of key importance to every shipowner concerning the competitive freight rate set and considerable net revenue - desirable net revenue.

Observing from this angle, we may see the trend as follows: so far the technology has already made it possible to man a merchant vessel with 6 highly qualified personnel, if not zero as is the case in the Japanese Milkway Project. However, the real practical manning level depends first on the market level of freight rate, and secondly on the careful choice by the specific owner based on his optimum breakeven point after the complicated calculations and comparison plus other necessary political, economic and social considerations.

Moreover, three points have become clear:

- (1) It is not at all a difficult mathematic calculation for shipowners to make good use of the international seafarer market
- (2) Detailed research work initiated by the industrial needs has made it possible to rationalise the ship design and layout and identify the workload in various kinds of vessels engaged in different trades under different conditions, thus meeting the needs of financially-pressed shipowners, coincidentally or specifically.
The joint force of these two plus governments has formed the trend of lower and lower manning scales. Whether it is a move towards optimum utilization of human resources, or whatever, it will be one important factor for each individual shipowner or operator to consider when manning each specific ship, if not specific voyage.
- (3) The trend towards higher technology and fewer crew require higher and higher qualification of the crew both in terms of knowledge and expertise. This implies that MET will have to adjust itself and provide a smaller number of higher qualified graduates of all levels and make all necessary updating courses available for training in the new technology.

VI. SPECIALIZATION

Coincident with the trend of specialization in current industrial development, the shipping sector of the industrialised countries also move towards specialization as one strategy to keep competitive and profitable in the depressed and competing market. The fact that they are able to do so is attributed to their comparative advantage of high technology and the further splitting and reformation of the markets; they have to do so because of the growing competition and huge overtonnage in all the major traditional markets.

There are already many highly specialized and sophisticated types of ships in service to meet the market demand. In addition to long existing LNG and LPG, these are:

- Car/truck carriers
- Car/container carriers
- Container/bulk carriers
- Bulk cement carriers
- Self-unloaders
- Slurry carriers
- Molten sulphur carriers
- Molasses carriers
- Livestock carriers
- Specialized heavy lift vessels
- Woodchip carriers
- Warehouse vessels
- Wine carriers
- Offshore activity-related ship types
- etc.

The essential requisites of going into these specific trades or services are basically two:

- high initial capital investment, and
- high operational technology and expertise.

Up to now, in both of these areas, the industrialised countries are enjoying almost absolute advantage, therefore enabling them to dominate the market. For instance:

- (1) LNG/LPG fleet: about 80%;
- (2) Pure car/truck carriers: almost 100%,
among which half are run by the six major companies: 3 Japanese ones - Mitsu; O.S.K., NYK, KOWASAKI; the other 3 are Scandinavian - Wallenius, HUAL and NOSCA. The other half are run by industrial carriers such as Nissan and Volkswagen, etc., and a few other carriers.

No wonder why quite a few of them believe that "specialization will increasingly be the keynote of successful ship operators".

This trend also implies that guaranteed access to cargo will become even more important. Presently, they are guaranteeing the cargo mainly by long term contracts with fixed customers and partly by providing liner service with open rates or chartering, also by, needless to say, providing very high quality and reliable service.

When observing the trend, we should notice another two implications:

- (1) The possible diminishing of the present conventional bulk carrier fleet, replaced by more specialised fleet over

- the long run, and
- (2) The present uneconomic factor of some very specialised ships due to the high capital cost, high freight rate and the resultant less possibility of fully utilizing these ships. This, then, slows the development of the trend for the time being.

The percentage of the total specialized fleet is, to this point, not really significant, but evolving technology is worth noting and may show us where "the productivity gains of the 1990s will be realized" (Ref. RB 1.A-1).

Another obvious point is the increasing demands for higher qualifications for crews to ensure safer and more efficient operation of these ships.

CHAPTER 3

SHIPS AND SHIP OPERATION

I. SHIPS AND SHIP TECHNOLOGY IN THE 1990S

What kinds of ship will be seen trading across the oceans in the 1990s? What level of technology will be exploited on board then? It is impossible for one to give or get any detailed and accurate answer, for in the modern world new technologies, new inventions and new innovations are evolving all the time; but on the other hand, it is not that difficult to see the general trend of development.

First, we must be fully aware of the technical applications on board the existing fleet of less than 10-14 years old. Based on the previous analysis, more than 70% of them will still be in service until mid 1990s and 40% until the end of that decade.

Secondly, we must keep a close eye on the ships ordered and under construction. They will go into the 1990s with the newest applied technology. The new designs, though may evolve some new breakthroughs, but they are generally limited by an unavoidable lead time before finally commonly accepted and adopted.

To open the discussion, let us first review the major technical changes that have taken place during last 20 years. According to Mr. Stonebridge, Director of Drewry Shipping Consultants Ltd., the following might be listed:

Table 3.1 (RB 1.A-1)

1962	First nuclear-powered merchant vessel (Savannah) completed.
1965	Order of first 165,000DWT supertanker.
1966	first transatlantic crossing by a container vessel. Second-generation container vessels (1,000-1,500 TEU) ordered.
1969	Record for power installed on a container ship: 120,000 hp and 33 knots. First barge carrier (Arcadia Forest) completed.
1970	Savannah laid up.
1973	Price of oil increased 4 times.
1976	Batilus, a 550,000DWT VLCC, completed.
1978	Re-engining of 80,000 hp class container ships begins.
1979	First non-damaged VLCC (219,000DWT, 1969-built) scrapped for economic reasons.
1982	First new-generation coal-fired bulker completed.
1983	Pierre Guillaumat (550,000DWT ULCC, 1977-built) scrapped.

From the list we can easily see that:

- (1) the increasing rate of technological change, and
- (2) reasonably assume, as the author did that some of the highly specialized vessels delivered during these years might be operationally obsolete by the early 1990s owing to economic/technical factors. The fact is that when new ships are introduced which prove to be more cost-effective and

many surplus to requirements, as is the case with present coal carriers, the old ships become and are recognised uneconomic.

(3) However, the majority of the fleet will continue to trade throughout their service life.

Generally speaking, the 1970s' oil crises and economic recession were the turning points in ship technology development. The 60s and 70s was a period of changing commodity transport. New ships types, larger and of higher power were in real fashion and the principles of economies of scale were starting to be deployed in shipping. Focus was on improving earning capacity by reducing the relative costs. Whereas, in the present, developments are chiefly directed towards the reduction of costs, in fuel consumption, in manning and in maintenance. (Ref. RB 1.A)

Fig. 3.1 illustrates clearly that bunker cost ranks first among all other costs, as well as the manning costs in the whole umbrella of ship's operating costs. Naturally, these are where the emphasis lay.

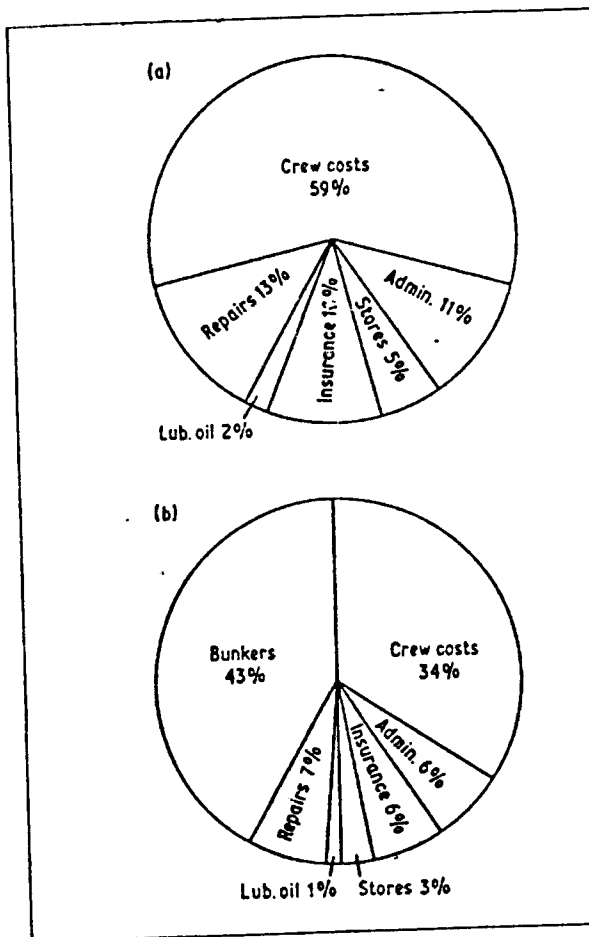


FIG. 3.1 comparison of ship operating costs (a) excluding bunker cost and (b) including bunker costs to show influence of charging bunker costs on relative crew costs

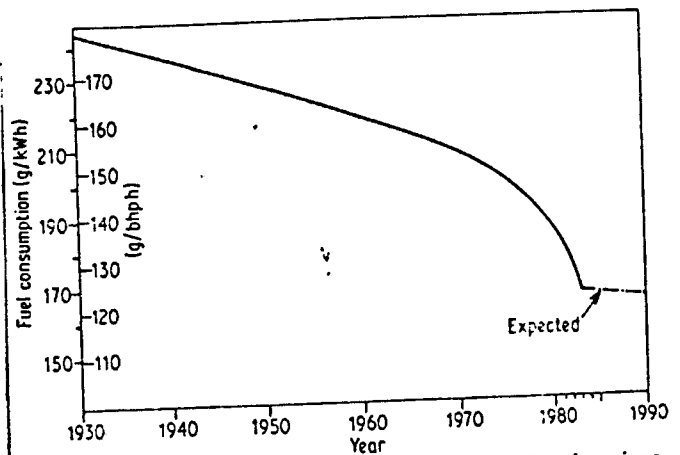


FIG. 3.2 Specific fuel consumption of two-stroke diesel engines over 50 years

Trans I Mar E (C), Vol. 96, Paper 17C-10

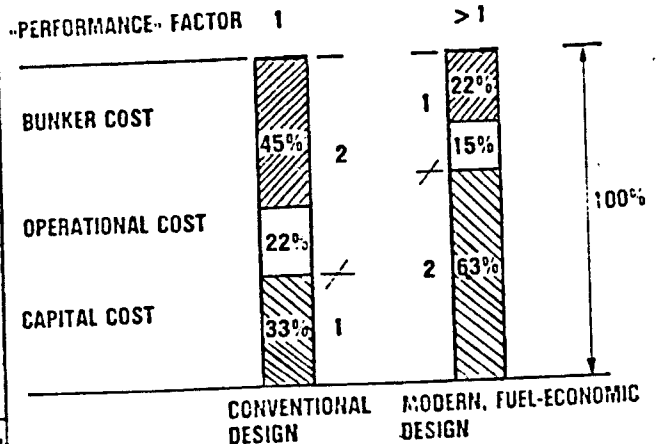


FIG. 3.3 Cost distribution patterns: conventional/modern mid-bulk ship designs

Trans I Mar E (C), Vol. 96, Paper 17C-5

A. Fuel Consumption Issue

From the point of view of ship design, innovations started in 1980s. Apart from the temporary fuel costs saving measures such as slow steaming and conversions from steam to diesel, recent designs of diesel engines have made it possible to achieve considerable reduction in fuel consumption and are expected to improve further, with a modest decrease in special fuel consumption. (See Fig. 3.2 RB 1.A-10)

The reduction of engine speed leads to the adoption of "slow" running propellers on bulk carriers, tanders and multi-purpose and container vessels. Fig. 3.3 (RB 1.A-5) shows a drastic changes in the cost-distribution pattern between a conventional midi-bulk vessel built before mid 1980s and a modern fuel-economic midi-bulk vessel.

Liner vessels have also undergone a remarkable reduction in design speeds; container and ro-ro vessels, needing good stability and being sensitive to fuel consumption in operations, have experienced the same. Take two cases for comparasion:

- (1) Hapag-Lloyd 1981 built third-generation container:
3,035 TEU, 51,540 DWT, engine 65,680 bhp, 24 knots service speed.
- (2) US Lines 1984-built fourth-generation Jumbo container vessels:
4,582 TEU, 58,870 DWT engine 28,000 bhp, 18.5 knots service speed.

Comparing the two cases, the drastic development in ship technology is self-evident.

Of course, this is not the cure-all remedy to most cases. The overall energy optimization is the final goal. The designer's considerations are drawn on the trade and route requirements and physical constraints to determine the ship's main dimensions and on fuel prices and the economics of shipping and shipbuilding at the same time so as to arrive at the best combination of the relative value of hull-building costs and fuel costs. (See Fig. 3.4 RB 1.A-10).

Besides the efforts on fuel saving in the propulsion system and optimum ship design, other aspects that could lead to overall fuel economy are also subjects of study and are gradually improving. Taking the example of mv Nautic, an "energy reduction" reefer vessel built by Gebr. van Diepen Shipyard - 30% of fuel cost saving compared with conventional vessels, was achieved through

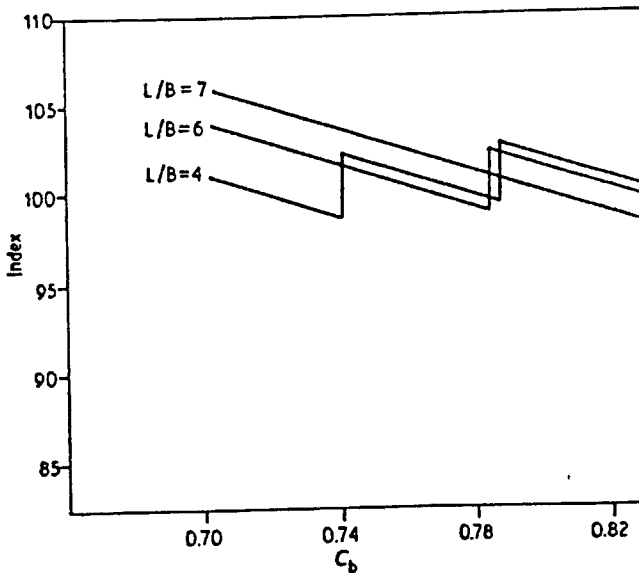
- optimizing the propulsion system,
- the use of a self-adaptive autopilot system and
- the installation of a shaft generator,
- together with the reefer plant fuel saving by use of heat exchangers to cool the fresh ventilation air by the exhaust air from the holds
- the use of fans with adjustable speed by frequency control
- and a number of combined functions of the ship's system and the cargo systems. (Ref. RB 1.A-10)

On the other hand, the greatest potential for energy saving lies in the ship operation side. Typical examples of specific measures, such as hull care (follow-up of hull fouling),

optimized docking, optimized trim, weather routing, voyage optimization (speed vs T/C rates) and tonnage utilization are taken up and have gotten more attention as management tools including the improvement of ship-shore communications.

Fig. 3.4

Building cost index for designs with identical deadweight and speed



(Steel hull: approximately 35% of total cost)

BUILDING COSTS INDEX

For ships with identical speed and deadweight; variation of main dimensions for different values of C_b and L/B.

(a) Steel hull approx. 35% of total costs:

	$C_b = 0.72$	$C_b = 0.77$	$C_b = 0.82$
L/B = 4	100	100.4	100.9
L/B = 6	102.9	100	100.2
L/B = 7	104.9	101.9	98.7

(b) Steel hull approx. 50% of total costs:

	$C_b = 0.72$	$C_b = 0.77$	$C_b = 0.82$
L/B = 4	100	100.4	101.2
L/B = 6	104	100	100.3
L/B = 7	107	102.7	98.2

CAPITAL AND FUEL COSTS INDEX

(a) High fuel and low steel costs:

- For a ship with relatively high fuel expenses due to high fuel prices or due to relatively high number of seadays per year.
- Ship with relatively low costs for steel hull due to low shipbuilding prices or to relatively high share of outfit materials.
- Capital costs approx. 20% of investment.

	$C_b = 0.72$	$C_b = 0.77$	$C_b = 0.82$
L/B = 4	101.8	107.1	119.5
L/B = 6	99.0	100.0	106.4
L/B = 7	97.0	98.0	99.7

(b) High fuel and high steel costs:

- Ship with relatively high share of steel hull price in the capital costs.

	$C_b = 0.72$	$C_b = 0.77$	$C_b = 0.82$
L/B = 4	102.3	109.2	124.8
L/B = 6	99.0	100.0	108.0
L/B = 7	97.2	97.8	99.7

(c) Low fuel and low steel costs:

	$C_b = 0.72$	$C_b = 0.77$	$C_b = 0.82$
L/B = 4	101.0	104.5	117.3
L/B = 6	101.0	100.0	104.0
L/B = 7	101.0	100.0	99.0

(d) Low fuel and high steel costs:

	$C_b = 0.72$	$C_b = 0.77$	$C_b = 0.82$
L/B = 4	101.4	105.9	115.9
L/B = 6	100.9	100	105.1
L/B = 7	100.3	100	99.1

B. Ship Automation

In the present world, the impact of automation is universal and deep. So it is in the shipping field. Both at present and in the future, the realization of optimum ship performance will have as requisites:

- (1) safer, more efficient and more economical ship operation
- (2) manning reduction to cope with the inevitable increase of labour costs on the one hand and to minimize possible human errors on the other.

The availability of the technology, reinforced by computerization and its general acceptance by the shipping world accelerates the trend and makes a faster penetration and popularization of automation to all possible corner on board ships.

Automation, the use of control system to replace or assist manual operations in ship handling and management and its machinery, has two major functions or elements:

- (1) monitoring - to compare the required and achieved values and produce an error signal;
- (2) informing the operator of the error in off line systems and/or correcting the error through actuator in the fully automated on line closed loop systems.

Generally speaking, ship automation has been applied and continues to be developed in the following five areas:

- Navigation
- Machinery
- Deck/Cargo
- Communication
- Management and administration

If properly applied, designed and installed, it will provide:

- safer and more consistent management and operation of ship's plant than is possible by manual control;
- optimum operation of the ship and its plant, reducing fuel consumption and wear and tear;
- a reduction in the ship operation and management tasks leading to reductions in manning and staffing. (RB 1.C-5)

Table 3.2 is to briefly illustrate, according to shipboard activities, the present development and application of ship automation, the functions performed as well as the future trend. (Ref. RB 1.C-5, 1.A-5, 1.E-10, Norcontrol Automation, HDW etc.) (Ref. 3.4)

Table 3.2 Shipboard Automation

PRESENT DEVELOPMENT			FUTURE TRENDS	
ACTIVITIES	AUTOMATION APPLIED	FUNCTIONS	AUTOMATION TO BE APPLIED	FUNCTIONS
A. NAVIGATION # ship positioning # hazards # machinery status & performance # passage planning	- computer linked radar/ARPA - automatic plotting - automatic chart display - navigation aids - integrated link to data sources and banks	- display and inform present situation - carry out "what if" exercise - enable available options to be assessed - passage planning - effective fuel consumption control	- track control system (deep sea - via satellites coastal water - via radar position receiving system) - electronic navigation charts - centralized bridge (integrated navigation system)	- optimum routing - collect, analyse and present data and information - exercise central control
B. MACHINERY # machinery surveillance & control # condition monitoring # performance monitoring # fault diagnosis # records & logs	- LMS+remote bridge control - systems monitor & control (in some cases) - power management system - automatic data recording by using surveillance system sensors	- centralized control, rationalization of deck & eng. room duties - reduce onboard maintenance and repair tasks 1) by selecting machinery for minimum maintenance 2) by correct operation of machinery to minimise wear & failure - performance control & monitoring - quickly indentifying prime cause of failure	- integrated part of ship operation center (SOC) board management center (BMC) (Fig. 3.4, 3.5, 3.6 & 3.7)	- (See Fig 3.5 and 3.7)
C. DECK & CARGO (activities split between: bridge, cargo control center and machinery control center) # cargo & ballast 1) status 2) handling 3) planning # mooring & berthing (in a few cases)	- (available in tanker operation) - bridge remote-controlled mooring equipment - bridge controlled davits	- operation monitoring & control - assist mooring with one crew member - pass mooring ropes to shore with minimum efforts	- smart sensors (sensors with built-in micro-processor) - centralised, overall display of information (Ref. Fig. 3.4-3.7)	- safer operation - manning reduction by combining the deck/cargo control function with bridge &/ machinery control centers
D. COMMUNICATIONS	- automated radio office - telex	- receive information, etc. beyond day-time working hours	(compatible) - part of integrated ship electronic automation system - FMDSS & INMARSAT communication - integrated ship/shore communication system	- ship/shore, ship/ship communication - close liaison between ship and shore staffs - information exchange and presentation - passage & voyage management - instant display of system faults, performance & condition data for comments and diagnosis
E. MANAGEMENT & ADMINISTRATION # accountancy # stock control # maint. & repair # ship records # ship's staff records	- computer terminals for manual data inputs and PCs	- information/data 1) recording 2) presentation 3) analysis 4) transmission	- ship/shore data link (via D above) - Expert Systems - computerized planned maintenance program	- automatic updating ship computer data basis - ship operating budgets & costs - rule & regulation revision - replace periodical planned maint. based on maint. manuals - maint. planning and executing

Notes: (Table 3.2)

Electronic navigation charts:

An electronic chart system can present the information which is traditionally shown on nautical paper charts and in supplementary books as well as other nautical information on an electronic display. It works as the output end in an integrated navigation system or information system. It contains the digital hydrographic chart as a fundamental subsystem, combining:

- digitized and stored chart information
- actual navigational information of own ship
- radar image fitted to the chart outline,
- etc.,

showing on one CRT display the mariner's most important information about

- geographics and hazards to navigation
- own ship's position
- other ship's position
- environment data.

Expert Systems

An Expert System is an artificial means for recording and obtaining access to human competence. It is a knowledge-based problem-solving program, depending for its operation on the use of facts and rules. Different from a conventional information processing system (generating answers for "what is" questions, it attempts to answer questions of the "what if" type.

The potential range and number of applications of Expert Systems is unlimited. The most obvious shipboard applications are in areas such as machinery fault diagnosis, hazardous cargo information, international documentation, navigational information and fuel characterization, etc.

Three principal elements of an Expert System are:

- knowledge base
- knowledge manager: independent of the application and providing control structure for the system
- situation model.

The system has the ability to "learn", to infer and to identify new relationships, thus to acquire new knowledge for itself.

fig. 3.10 shows a generalized description of the Expert System used at Lloyd's Register. (Source: P117 RB 1.F)

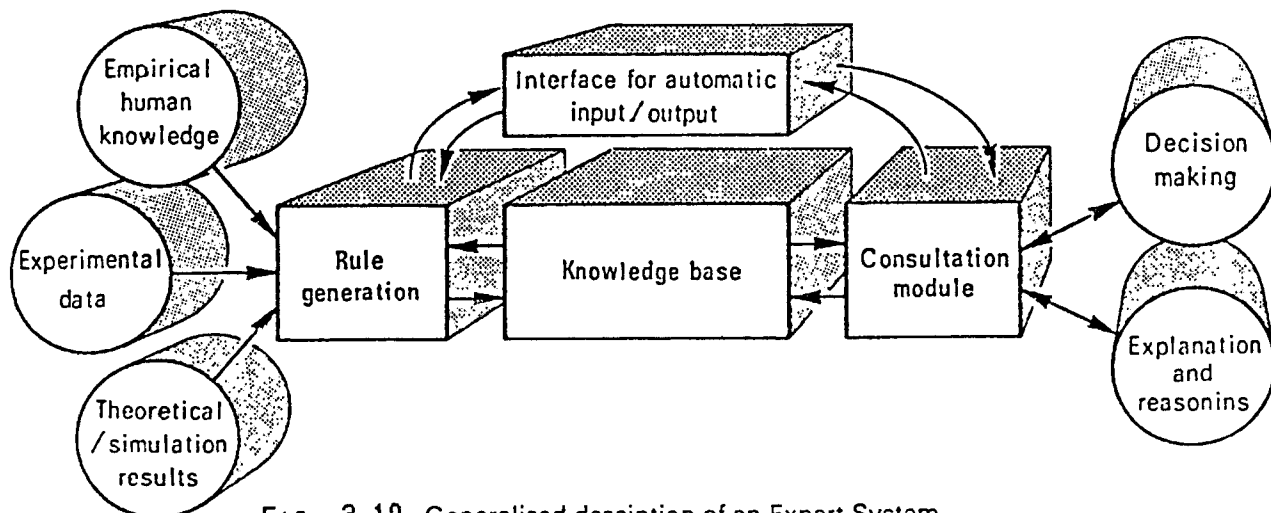


Fig. 3.10 Generalised description of an Expert System

Stressing future development of ship automation, we can confidently expect to take greater advantage of the potential offered by computerised automation when:

- the present fragmented approach to and application of automation gives way to integrated systems. Fig.3.4-3.6 and 3.7 are examples developed by Flensburg Research Institute for Ship Operation(FRG) and Norcontrol Automation(Norway)- The Integrated Ship Automation Systems, which have already equipped on board their pilot ships for the projects of "Ship Operation of the Future".
- the standardization of equipment and their interfaces are gradually reached.
- the ship/shore organizations for operating ships and the demarcation of responsibilities are rationalized, (to be discussed in Section II).

As summarised by D.N. Loynes in his paper Shipboard Automation and Its Future Potential, the development and exploitation of automation on board will benefit future ships with:

- reduced built-in operations and maintenance tasks;
- more computer based automation covering all ship activities;
- data links and highways between dedicated but compatible computers for data transfer
- combined control centers concentrating navigation, machinery and cargo/ballast surveillance and control in one or two centers at most;
- a reorganized structure of responsibilities for navigation, machinery and cargo activities;
- computer based ship/shore communication links.

Just to add a few points:

- The VDU concept on control, now fitted in aircrafts, will make its way to the ship bridge with satellite terminals around the ship. (This will change the concept of watchkeeping and will necessitate all deck officers having a fuller understanding of engineering.)
- robotic solutions to problems like hatch cleaning, hotel cleaning, painting, etc.

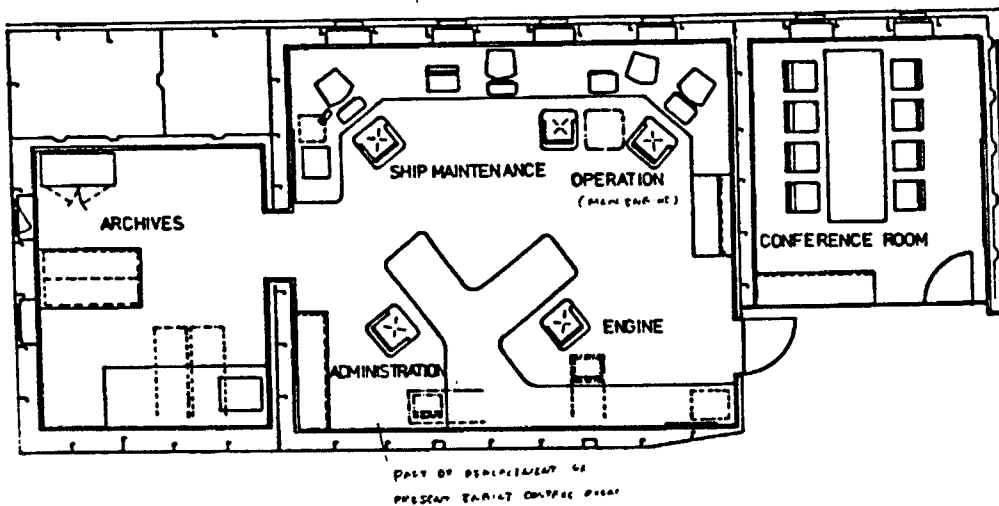
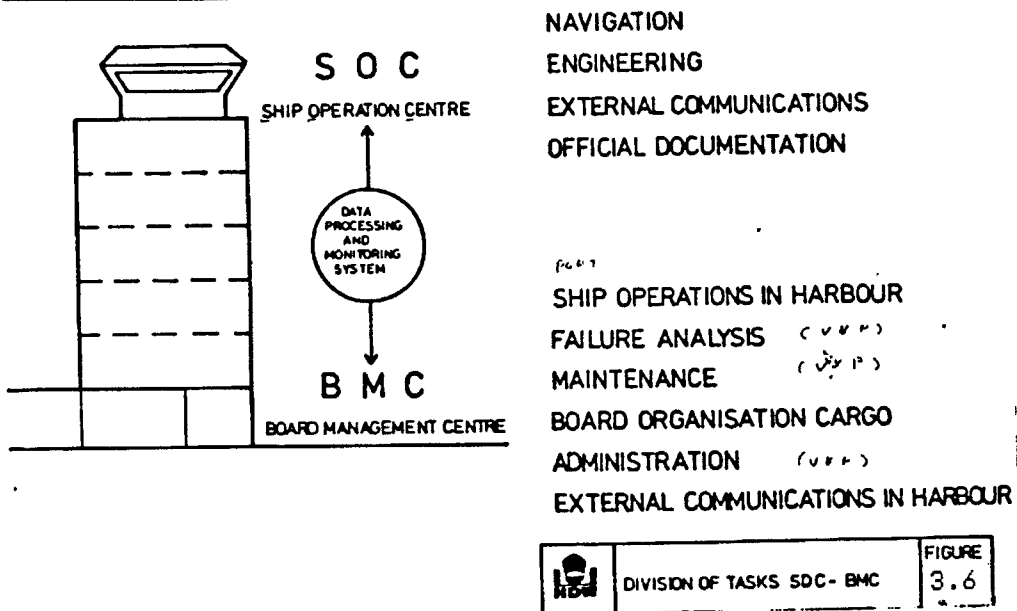
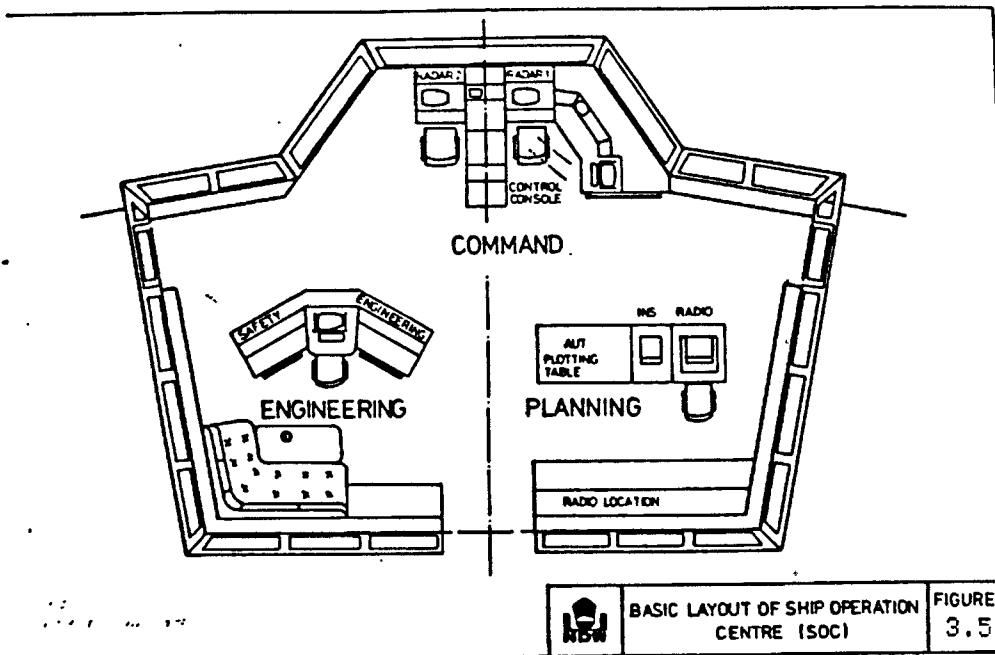


Fig. 3.8
**INTEGRATED VESSEL AUTOMATION SYSTEMS
 OVERVIEW**

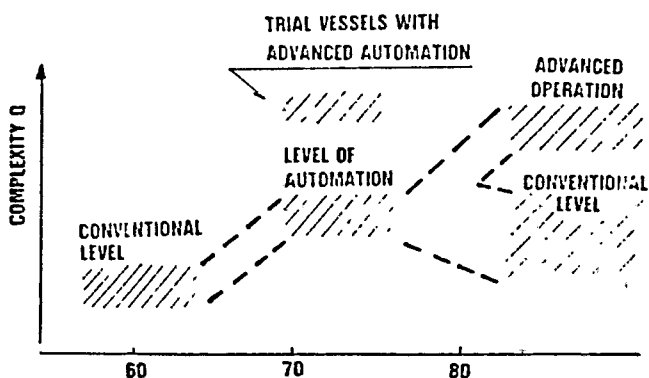
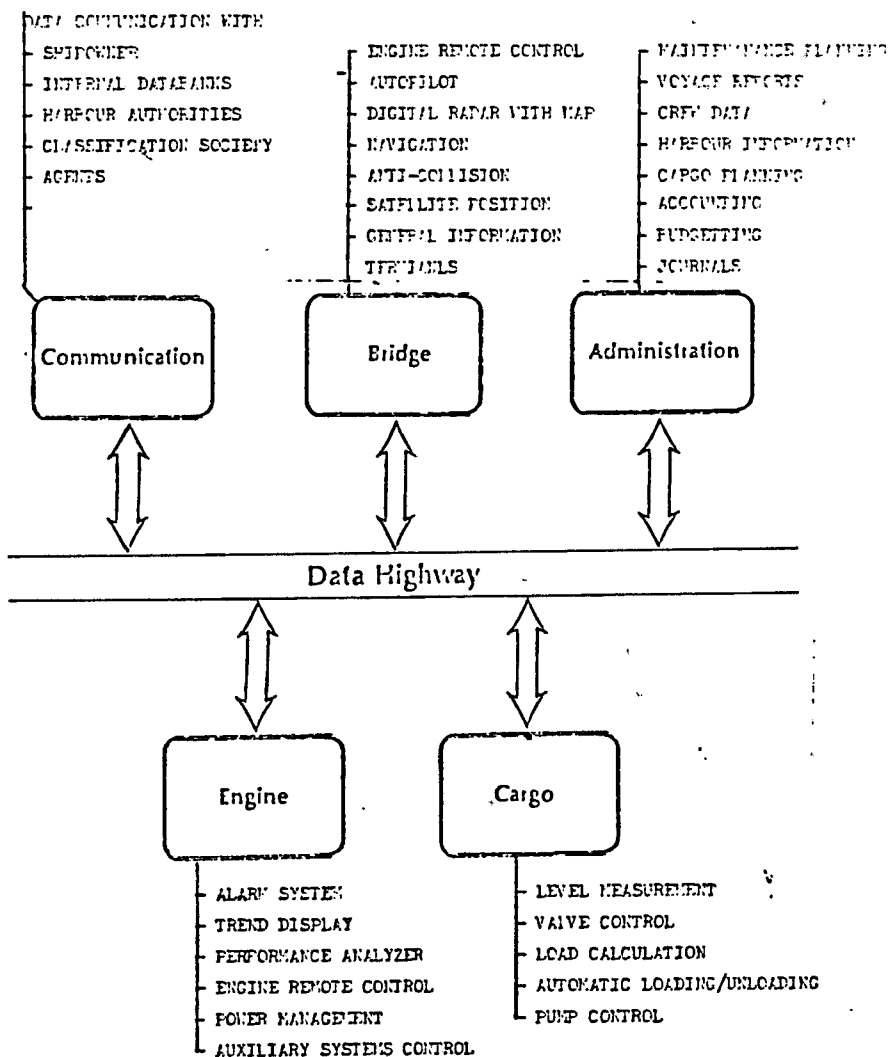


Fig. 3.9 Development of 'vessel complexity'

	IMMEDIATE	INTERMEDIATE	LONG TERM
GENERAL CRITERIA	<ul style="list-style-type: none"> Could be achieved immediately either by purchase of rationalised ship design or equivalent No proving of basic concepts Minimal changes in ship/shore relationship Existing watchkeeping and operational practices Legally acceptable within current legal framework 	<ul style="list-style-type: none"> Could be achieved by modification to existing modern vessel Limited proving of concepts may be necessary Some changes necessary to ship/shore relationship Some changes to watchkeeping and operational practice May require some modification to existing legislation 	<ul style="list-style-type: none"> Could only be implemented on a newbuilding Considerable research and development required Substantial changes to ship/shore relationship required Major changes to watchkeeping ship/shore relationship At divergence with existing legal requirements
TIME FRAME	1985/86	1989/90	1990 onwards
MANNING LEVEL	18-17	14-12 <ul style="list-style-type: none"> Level dictated by competition identified below 	Less than 12 <ul style="list-style-type: none"> Nominal range 11-9 Level to be established during Phase 2
EXISTING OR EMERGING DESIGNS/PROJECTS	<ul style="list-style-type: none"> Japanese Rationalised Ship, Phase 'A' Rationalised Ships III Freedom MkII British Shipbuilders MP17 Evergreen Line 'C' Class 	<ul style="list-style-type: none"> German newbuildings Blumenthal, Bremerhaven German newbuildings HDW, Hulls 207, 208 Norwegian newbuildings Japanese Phase 'C' Rationalised Ships 	<ul style="list-style-type: none"> German SdZ 90 Japanese Intelligent Ship
COMMERCIAL TARGET	<ul style="list-style-type: none"> To be competitive with average ITF (Far East) manning levels of 30-25 	<ul style="list-style-type: none"> To be competitive with ITF operators with manning levels 25-18 and low-cost Flag of Convenience operators in the range 30-25 	<ul style="list-style-type: none"> To be competitive with Flag of Convenience operators with manning levels down to 18

Table 3.3 DESIGN TARGET SUMMARY SHEET 1

	IMMEDIATE	INTERMEDIATE	LONG TERM																																						
POSSIBLE COMPLEMENTS FOR LOW MANNED SHIPS	<table> <tr><td>Master</td><td>1</td></tr> <tr><td>Deck Officers</td><td>3</td></tr> <tr><td>Radio Officer</td><td>1</td></tr> <tr><td>Engineer</td><td>3</td></tr> <tr><td>Ratings:</td><td></td></tr> <tr><td> Deck</td><td>4</td></tr> <tr><td> Engine</td><td>2</td></tr> <tr><td> Catering</td><td>3</td></tr> <tr><td>--</td><td>--</td></tr> <tr><td></td><td>17</td></tr> </table> <p>BASED UPON EVERGREEN 'C' CLASS</p>	Master	1	Deck Officers	3	Radio Officer	1	Engineer	3	Ratings:		Deck	4	Engine	2	Catering	3	--	--		17	<table> <tr><td>Master</td><td>1</td></tr> <tr><td>Deck Officer</td><td>2-3</td></tr> <tr><td>Combined RO</td><td>1</td></tr> <tr><td>Engineers</td><td>3</td></tr> <tr><td>Ratings:</td><td></td></tr> <tr><td> CP</td><td>4-5</td></tr> <tr><td> Catering</td><td>2</td></tr> <tr><td>---</td><td>---</td></tr> <tr><td></td><td>13-15</td></tr> </table> <p>BASED UPON RECENTLY ANNOUNCED NORWEGIAN MANNING SCALES</p>	Master	1	Deck Officer	2-3	Combined RO	1	Engineers	3	Ratings:		CP	4-5	Catering	2	---	---		13-15	
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Master	1																																								
Deck Officers	3																																								
Radio Officer	1																																								
Engineers	4																																								
Ratings:																																									
CP	6																																								
Catering	3																																								
--	--																																								
	18																																								
Master	1																																								
Deck Officer	1																																								
Radio Officer	1																																								
Watchkeeping Officers	2																																								
Engineers	2																																								
Ratings:																																									
CP	6																																								
Catering	2																																								
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	15																																								

Table 3.4 DESIGN TARGET SUMMARY SHEET 2

	IMMEDIATE	INTERMEDIATE	LONG TERM
SHIPBOARD ADMINISTRATION	<ul style="list-style-type: none"> Increased use of shipboard computer, applications will include planned maintenance and stock control Significant proportion of Master/Chief Engineer's time absorbed in routine paperwork Increased use of enhanced telecommunications but mainly at low data transmission rates 	<ul style="list-style-type: none"> Significant adoption of management computers Reduction of Master/Chief Engineer's administrative load to less than 50% of present level Master/Chief Engineer available for operational duties Standard range of software to be developed covering range of ship types 	<ul style="list-style-type: none"> Extensive use of satellite communication and data transmission to reduce onboard administration to a minimum (less than 20%) Paperless administration including log keeping, routine documentation, personnel and accounts
MAINTENANCE	<ul style="list-style-type: none"> Maintenance mainly carried out by shipboard staff Limited use of condition monitoring for maintenance prediction 	<ul style="list-style-type: none"> Maintenance to be carried out by shipboard staff supplemented by riding squads Maintenance prone components/systems to be designed out or replaced 	<ul style="list-style-type: none"> Machinery space to be designed from first principles for minimal maintenance against a maintenance target Extensive monitoring of propulsion & auxiliary machinery
ENGINE ROOM DESIGN AND OPERATION	<ul style="list-style-type: none"> Conventional machinery space design Some modifications to eliminate day work and ease maintenance Automated to UMS 16/24 hour operation Limited automation of auxiliaries 	<ul style="list-style-type: none"> Engineering systems to be modified/replaced for ease of operation/automation Automation to be extended to wider range of auxiliaries Level of automation of propulsion/machinery to be extended 	<ul style="list-style-type: none"> Engine room to be designed from first principles for Unattended Operation for extended periods Engine room to be designed against a target reliability figure necessitating extensive knowledge of component reliability. All auxiliary systems to be self-sustaining.
BRIDGE OPERATION	Conventional bridge arrangement and watchkeeping	<ul style="list-style-type: none"> Integrated Navigation Systems to be used Limited changes to watchkeeping practices Lookout still required 	<ul style="list-style-type: none"> Cockpit bridge designed around concept of single watchkeeper Changes in legislation to permit reduced bridge manning Automatic systems for Hazard Detection

Table 3.5 DESIGN TARGET SUMMARY SHEET 3

	IMMEDIATE	INTERMEDIATE	LONG TERM
CONTROL LOCATIONS	<ul style="list-style-type: none"> Conventional Bridge Design and Layout Conventional Machinery and Cargo Control Rooms Some limited centralisation of control areas but using conventional technology, therefore bridge layout will be conventional 	<ul style="list-style-type: none"> Adoption of cable multiplexing and VDU technology for distribution and display of information Centralisation of control and monitoring in bridge area Elimination of conventional machinery and cargo control rooms 	<ul style="list-style-type: none"> Development of integrated bridge with provision for centralised watchkeeping and control All control and surveillance operations initiated, logged and monitored from bridge
COMMUNICATION (EXTERNAL)	<ul style="list-style-type: none"> Conventional radio installation augmented by satellite communication Satellite communication used mainly for voice/low speed data transfer Radio Officer, legally required 	<ul style="list-style-type: none"> Increased use of satellite communication New distress, search and rescue facilities available to free radio officer for other duties No legal requirement for Radio Officer 	<ul style="list-style-type: none"> High speed data transmission used as essential ship to shore link Automated communications No legal requirement for Radio Officer
AUTOMATION TECHNOLOGY	<ul style="list-style-type: none"> Conventional Automation Equipment Limited use of microelectronics within proprietary items of equipment 	<ul style="list-style-type: none"> Distributed microprocessor-based surveillance equipment used for machinery/cargo control and surveillance Improved reliability and ease of operation obtained by standardisation of components Cable multiplexing adopted to facilitate extensive monitoring and to reduce shipyard installation costs On-board data processing & VDU's used to facilitate presentation of information to operators First generation integrated system such as Racal Decca's MIEP equipment available Partial integration of ship control functions Fibre optics used for point to point data links 	<ul style="list-style-type: none"> Development/proving of totally integrated ship surveillance and control systems Adoption and local area networks to facilitate integration of control and monitoring Enhanced integrated ship electronics system (MIEP Mk.2) available

Table 3.6 DESIGN TARGET SUMMARY SHEET 4

11. SHIP OPERATION AND ORGANIZATION

Driven by the market, economic forces and technological development, optimism/optimization has been more and more stressed and favoured. The same is the case of ship operation, shipboard organization and the related task patterns or job distribution.

From previous discussions on market and technology development, it is easy to see the dominating trends towards "technologically advanced, capital-demanding and knowhow-intensive" ship operation and inevitable change of shipboard organization. As a consequence of automation and modern information technologies, the traditional shipboard tasks are changing away from handling "things" to handling data and managing people. With respect to human satisfaction and development, the most essential factors will be work organization, efficiency, training, decision-making delegation, job enrichment and career patterns.

Let us examine what is happening in most of the advanced fleets: With the objective of retaining market competitiveness, higher capital investment has been continuously made, and greater attention has been focused on compensating higher labour costs with other competitive factors such as:

- greater operating efficiency
- better service quality
- improved safety and reliability
- improved marketing.

The following means have been widely adopted in rationalization of ship operations:

"Hardware":

- use of materials with increased functional or maintenance reducing effect
- increased use of instrumentation and automation to improve monitoring and increase operating reliability and safety
- investment in design, equipment and operational systems that optimize fuel economy
- investment in labour-saving aids

"Software":

- workload studies and considerations to reach the right combination of technology and people, the key to successful ship operation, to ensure optimum performance
- ergonomical considerations in working space layout and arrangement, e.g. research projects carried out in the Netherlands, Norway, West Germany, U.K., Japan, etc. (See Annex 2)
- introduction of efficient and more human-oriented methods in organization of work and job satisfaction
- upgrading the management functions onboard and on shore through increased use of advanced communication medium and computerization on all levels as well as system analysis and modern planning techniques and other management tools and methods, etc. (Ref RB 1. A-5)

Manning reduction onboard is both the driving force and inevitable outcome of the above, in line with the replacement of the corresponding modern operating and management patterns with

the traditional ones.

Neither productivity nor safety can be obtained by means of advanced technology only. The center of the issue is to man a ship with the right number of personnel with the required competence by combining various qualifications for each person to match workloads and operational procedures demanded.

Two influencing elements in this respect are:

- the functions: all the tasks influencing safe and efficient operation of the ship
- the conditions: all the factors influencing the workload and the qualification required to carry out the various functions.

Traditionally, shipboard work organization has been divided into separate tasks and separate work plans, operating in the form of rigid disciplines and hierarchy as shown in Fig 3.11.

Nowadays, as a consequent result of the market pull and technology push, significant changes are taking place on board ships, where traditional organizational walls and ceilings are giving way or being torn down while role flexibility across departments and across ranks are practically required to achieve effective manning.

1. Vertical Hierarchy Ceilings:

The introduction of automation and modern ship design is diminishing most of the traditional seafaring chores and has allowed the great reduction in the middle level jobs, including engine watchkeeping, and some lower level jobs such as painting, hold cleaning, breakdown maintenance and repair. Reinforced by the cost-saving oriented demanning, the ratio of ratings to officers has fallen from over 2:1 to 1:1 and in "ships of the future", the ratio will be 1:2 or even 1:3. (See Fig 3.12). Traditional principles of differentiating between officers and ratings are no longer tenable when the conventional officer-rating divisions both at the work place and socially are disappearing as tradition gives way to a more stratified manning. Officers are doing some work traditionally allocated to ratings, such as hold cleaning; an officer's practical capability is now as valuable as his academic achievements and professional knowledge.

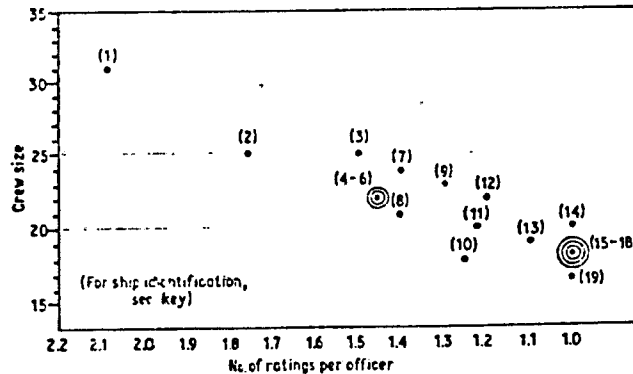
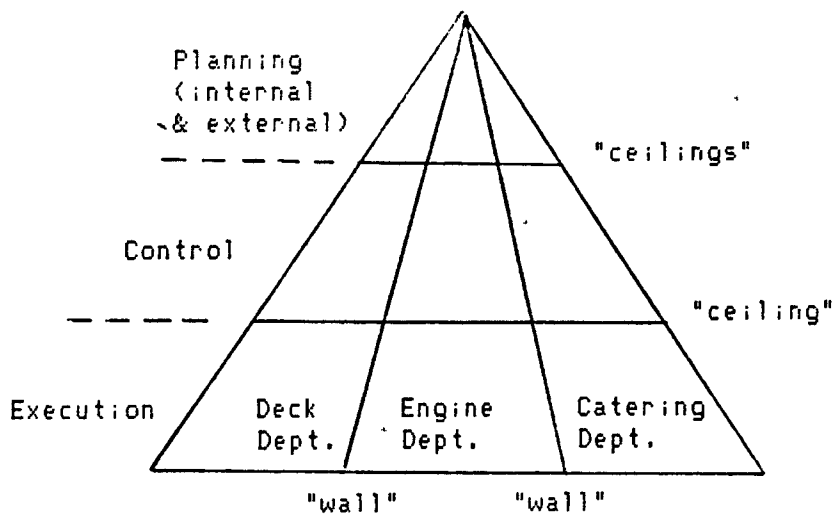
2. Horizontal Walls

Conventionally manned ships were staffed so that each department could meet its responsibilities for the functions delegated to it and its peak workloads. On the way to achieving effective manning, the variations in work patterns are being acknowledged and peaks smoothed out; discipline/departmental divisions relaxed; and all crew members are being trained and expected to carry out a wider range of tasks on a non-departmental basis. (Ref Annex 2, RB 2.4 4/87 p.11)

For example:

- Multi-roles:
 - the combination of navigational and cargo functions in all ships;
 - engineers and mates working together on cargo functions in oil, gas and chemical tankers;

Fig. 3.11



Source: D. H. Moreby

- | | |
|--------------------------------|----------------------------|
| Key: 1. ZIM EO | 10. Erlangen Express |
| 2. Erlangen Class (conversion) | 11. 'Dana Arabia' Class |
| 3. NYK standard EO | 12. Montebland Maru (22) |
| 4. Loire Lloyd | 13. Hikawa Maru |
| 5. Evergreen standard EO | 14. Montebland Maru (20) |
| 6. Nedlloyd newbuilding | 15. Hakuba Maru |
| 7. MOL standard EO | 16. Canberra Maru |
| 8. Scandia Lines containership | 17. Nichigu Maru |
| 9. Maersk standard EO | 18. Thebeland Class (1980) |
| | 19. Everlight 'L' Class |

Reduction in number of ratings per officer with reducing crew size

Trans I Mar E (C), Vol. 96, Paper 17C-6

Fig. 3.12

- the functions of ship electrician officer having long been combined into that of ship engineer;
 - radio distress watchkeeping is to be relaxed and combined with other watchkeeping duties thanks to the exploitation of modern communication systems of telex, INMARSAT and FGMDSS, which will soon lead to the abolition of morse telegraphy;
 - Role flexibility across disciplines:
 - multipurpose ratings/GP ratings, ship mechanists(Norway);
 - dual certification as junior officers for both deck and engine room watchkeeping;
 - dual certification up to top ranks to serve either discipline needed.
- (To be further discussed in Chapter 4.)

3. Team work

There is an old Chinese proverb which says: "On board the same ship, share the common sailing." Teamwork spirit has always been essential for a safe, economic and efficient ship operation. On the high capital and low manning ships of today and tomorrow with crews of combined qualifications for combined functions it is and will be an absolute.

Shipboard Management Team (SMT)/Ship Operation Team (SOT) is already a common practice on board most of the European fleets. The team usually comprises the Master (as Chairman), Chief Mate, Chief Engineer, Second engineer, chief Steward and in some cases, the Bosun or Chief Petty Officer. They have scheduled meetings where work plans are drawn up and reports made on the day-to-day ship operating activities such as:

- tasks to be done
- labour availability and work allocation, (by naming individuals or on a self-selective basis according to the nature of the work)
- stores and spares
- budgetary constraints (in the case of decentralized fleet management system).

Hence there is optimum utilization of time, materials and human resources and the creation of a healthy atmosphere for maximum possible motivation, job satisfaction and sense of responsibility.

Full meetings of all crew members are held periodically for overall planning and reporting to make the whole team more unified and understanding - ready to co-operate and contribute for the good of all.

From another angle, engineers on board ships of UMS class, are seen working together as a team, handling all necessary practices and procedures to ensure the vessel is maintained in a safe working condition, at peak operational performance and with the absolute minimum of risk to pollution of the environment.

4. Ship/Shore Job Distribution

A. Maintenance and Repair (M & R)

This issue is a cost-effectiveness consideration of each individual company and depends on its operational policy.

With greater investment in automation and maintenance/labour saving equipment and ship design, and other labour-saving measures such as the use of long last paints, further reduction of manning levels is expected. As an alternative, some of the M & R jobs are being transferred ashore during dry-docking. The Japanese and others are experimenting with allocating well-trained shore maintenance teams in strategic ports around the world or using the local maintenance personnel.

B. Management

On one hand, decentralization is in practice in many companies which compete commercially and internationally with tight, cost-effective crews. Here the Master and senior officers are given the skills and authority to manage the ship, its crew, fuel and spare parts as effectively and efficiently as possible. In return, the companies insist on the Master and senior officers being accountable for their decisions and actions. Accountability goes to the very heart of the matter.

On the other hand, as mentioned in previous sections, the rapid development of communication facilities and capabilities plus computerization makes data and information transfer much easier and quicker. Centralized management and the control/monitoring of shipboard activities and performances, such as accounting, purchasing routines, budgeting and follow-up procedures, voyage optimization, bunker routines, etc., is already a fact to some degree in many companies in some advanced countries.

This change of decision-making pattern also leads to another issue, i.e. future qualification of senior officers:

- commercially oriented,
- technically oriented, or
- operationally oriented. This is to be discussed in later chapters.

III. VESSEL TRAFFIC SYSTEMS (VTS)

As is the normal case, the more sophisticated the instruments become, the safer the shipping becomes; and the more dependent on the shore the navigator on board becomes.

Aimed at providing assistance to guarantee safety of traffic and environment, efficient flow of traffic and aid to navigation, more and more Vessel traffic service systems/ vessel traffic management systems (VTS/VTMS) have been set up in different ports around the world - more than 300 up to now and more are under way. IMO has provided its Guidelines for VTS and EEC countries are conducting a thorough study on the present situation and future development of the system through its COST 301 Project. The final report of which will be delivered in 1988, more than two feet thick!

A VTS is, as defined in the IMO Guidelines for VTS (A578/14), "Any service implemented by a competent authority, designed to improve safety and efficiency of traffic and the protection of the environment. It may range from the provision of simple information messages to extensive management of traffic within a port or waterway." In short, it is "an institution that collects and provides information to achieve a safe and efficient flow of traffic" (RB 2.13 1/86 p.29)

In practice, existing VTS systems range from a simple VHF reporting and information system to a system with radar stations, VHF, bearing facilities, autotracking and information handling (by computers). The VTMS in Rotterdam is considered to be the largest and the most sophisticated. A brief introduction to the system is given in Annex 3).

The functions of a VTS are:
according to IMO:

- data collection
- data evaluation
- information service
- navigational assistance service
- traffic organization service
- support of allied activities

COST 301 classifies all the functions of information, surveillance, regulation, assistance to navigation, SAR, anti-pollution, monitoring of aids to navigation, etc. under the headings:

- (a) Primary functions, which include:
 - General rules, allocation of space, routine control of vessels, manoeuvres to avoid collisions
- (b) Enforcement functions
- (c) Remedial Functions
- (d) other functions

The demand for MET derived from the application of VTS systems on a worldwide basis is mainly in two areas, namely:

- normal operational procedure and co-operation, which are to be standardised internationally in the foreseeable future, aiming to prevent confusion from the viewpoint of safety and efficiency.
- communications, the language requirements in particular. This will be further discussed in Chapter 4.

CHAPTER 4

MARITIME EDUCATION AND TRAINING (MET)

The role of education, especially higher education, is to prepare the brains for the future. It equips a student with the necessary background knowledge and other required knowledge for his/her future speciality.

Training is to prepare the hands for the present and future and to help a student to apply some of the knowledge learnt from books or in classrooms.

According to the definitions given in the International Encyclopedia of Teaching and Teacher Education, education is "the systematic process of learning through learning"; training is "the learning of performance of one skill. It is the development of skills on knowing-how rather than knowing-that".

Seafaring is more of an applied profession, like medical doctors, which needs not only sound background and theoretical knowledge but also practical operational skills and experience. The MET therefore, is entrusted with the unique task to prepare both hands and brains.

Unlike education and training in the other fields, the lead time needed in MET is so long that it takes about ten years for a high school graduate to become a competent ocean-going ship captain or chief engineer. It is therefore a very challenging task to prepare seafarers for the future, particularly in today's rapidly changing and technologically advancing world, where different interests are interwoven and interacting, i.e. the economic aspects for shipowners, the safety and marine environment protection aspect for the maritime administration and employment/social aspect for seafarers and maritime academies.

MET, as it is, has come a long way to get today's development. For centuries seafarers were trained up on board ships going through winds and storms. In today's world shipping, seafarers are controlling, on a day to day basis, multi-million dollar investments (ships and cargoes) and their own and others' lives. Seafarers are now accepted and recognised very definitely as professionals. Just as any other professionals, they need a sound academic background to cope with the increasing demands on their expertise, much more than the narrow knowledge needed by "ship drivers" as some people would suppose.

I. PRESENT MAJOR SYSTEMS

There exist many different kinds of MET systems in the present world. These differing systems are a direct reflection of individual country's maritime policy, education policy and industry needs. More deeply, they are moulded and influenced by the countries' history, tradition, culture, political and economic system and development stage, etc. Nevertheless, as an education and training system geared to fulfil the demands of an industry of international nature, they have many points in

Table 4.1 MET SYSTEMS IN 15 SELECTED COUNTRIES

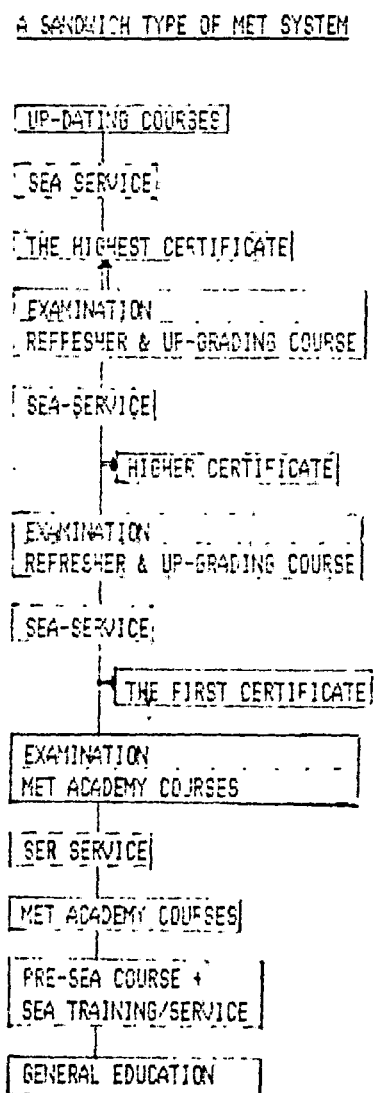
COUNTRY	(1) Authority in charge of MET	(2) Duration of Ed.	(3) Req. red. G. Ed. for Entry	(4) Req. red. Special Subjects	(5) Average age of Candidates	(6) Entrance Requirement/Exam	(7) Shorebased Introductory course	(8) Shipboard Introductory course	(9) Total MET Duration	(10) Shorebased studies	(11) Shipboard training w. th: MET	(12) Total Av. Weeks per Academic Year	(13) Av. number of Lectures per Week	(14) Duration per Lecture Hour	(15) Authority in charge Assessment	(16) Authority in charge Certification	(17) First Cert. of Competency Issued	(18) Academic Degree Issued	(19) Authority of Issuing	(20) Equivalence to Other Un. Degree	(21) Controlled Sea Service up to Master	(22) Min. Non-controlled Sea Service up to Master	(23) Min. Total Sea Service up to Master	(24) Minimum Age to get Master Cert.	(25) Total Cert. of Competency Issued	(26) Req. red. Cert. to Serve as Chief Mate	
EGYPT	M. n. of Ed. & Cultural Affairs	12 Y	11 Y	maths	18	BCE	none	200 sea training	3 Y	3 Y	none	32	25	45 min.	School	National Adm. of Shipping Navigation	Second Mate	BSc Degree	Min. of Education	BSc Degree	36 M	36 M	72 M	20	- 2nd Mate - Master	Master	1.
INDIA	M. n. of Industry & Commerce	12 Y	9 Y		16	BCE	5 M	20 M	5.1 Y	3.5 Y	(20 M)	40	30	45 min.	External Examiners from M. n.	Min. of Industry & Commerce	Second Mate	None	-	-	20 M	36 M	56 M	27	- 2nd Mate - 1st Mate - Master	1st Mate	2.
INDIA	M. n. of Ed. & Culture Affairs	12 Y	9 Y		16	BCE	none	none	4 Y	5 Y	1 Y	30	30	50 min.	School	Maritime Directorate	Second Mate	School Cert.	Min. of Education	BSc Degree	12 M	42 M	54 M	27	- 2nd Mate - 1st Mate - Master	1st Mate	3.
R.S.	M. n. of Ed., Science & Arts	12 Y	12 Y		18	BCE & Exam	none	9 + 15 M	3 Y	3 Y	none	37	30	45 min.	School	Min. of Transport	Deck Officer Cert.	BSc Degree	Min. of Education	BSc Degree	24 M	24 M	48 M	26	- Deck Off. - Master	Master	4.
S.A.	M. n. of Transport & M. n. of Education	12 Y	12 Y		16	BCE & Exam	none	none	4 Y	3 Y	1 Y	44	25	50 min.	US Coast Guard	US Coast Guard	Third Mate	BSc Degree	Min. of Transport & Min. of Education	BSc Degree	12 M	36 M	48 M	25	- 3rd Mate - 2nd Mate - 1st Mate & Master	Master	5.
S.S.A.	M. n. of the Merchant Marine	10 Y	10 Y		16	BCE & Exam	none	none	5.5 Y	4.0 Y	0 M	32	36	45 min.	School	Min. of the Merchant Marine	Second Mate	BSc Degree	Min. of Merchant Marine	BSc Degree	0 M	40 M	40 M	33	- 3rd Mate - 1st Mate & Master	Master	6.
UK	M. n. of Maritime Economy	12 Y	12 Y		19-20	BCE & Exam	none	none	5 Y	4 Y	13 M	32	34-40 incl. Lab hrs	45 min.	School	Marine Board Office	Watch-keeping officer	BSc Degree	Min. of Higher Education & Science	BSc Degree	18 M	40 M	73 M	25	- UK Officer - 1st Mate - Master	1st Mate	7.
GRI	M. n. of Transport	12 Y	12 Y	maths/science	18	BCE & Exam	none	none	4 Y	4 Y	4 M	33	32	55 min.	School	Min. of Transport	Mate Cert.	None	-	-	16 M	36 M	52 M	20	- Mate - Master	Master	8.
YPT	M. n. of Maritime Trans & M. n. of Foreign Affairs	12 Y	12 Y		(22)	BCE & Exam	none	none	3 Y 4.5 Y	2.5 Y 4 Y	4+(6/12M) 12 M	15-16 (+5-6)	15-21 credit hr.	50 min.	School	Min. of Maritime Transport	Third/ Second Mate	None BSc Degree	Supreme Council of Universities	BSc Degree	12 M	24 + 12 M	36 M	25	- 3rd Mate - 2nd Mate - 1st Mate - Master	1st Mate	9.
INDIA	M. n. of Ed. & M. n. of Communications	12 Y	12 Y		19	BCE & Exam	none	none	3 Y 4 Y	2.5 Y 3.4 Y	4 M 8 M	40	20	50 min.	School	Min. of Communications	Third/ Second Mate	Diploma BSc Degree	Min. of Education	Diploma BSc Degree	0 M	36 M	48 M	27-28	- 3rd/2nd Mate - 1st Mate - Master	1st Mate	10.
NORWAY	Ministry of Education	12 Y	12 Y		17-20	BCE & Exam	none	none	3 Y 4 Y	2 Y 3 Y	1 Y 1 Y	40	30	50 min.	School	None	Class 4 (Third Mate)	Diploma B.E. Degree	Min. of Education	Diploma B.E. Degree	12 M	4 Y 4 Y	7 Y 5 Y	30	- Class 3 - Class 2 - Class 1	Class 2	11.
INDIA	M. n. of Ed. (A) M. n. of Transport (B)	12 Y	9 Y (B) 12 Y (A)		14 (B) 19 (A)	BCE & Exam	none	none	3.5 Y 4.5 Y	4.5 Y 3.5 Y	1 Y 1 Y	36-38	20-25	40 min.	School	Min. of Transport	Third/ Second Mate	Diploma BSc Degree	Min. of Education	Diploma BSc Degree	12 M	40-60 M	60-72 M	27-28	- Class 4 - Class 3 - Class 2 - Class 1	Class 2	12.
INDIA	M. n. of Education	12 Y	12 Y		17	BCE	none	none	4 Y	3 Y	1 Y	37	32	50 min.	School & M. n. of Transport	Min. of Transport	Maritime Officer (52 + A)	Cert. of Higher National Education	Min. of Education	BSc Degree	12 M	48 M	48 M	20	- 2nd Mate & 3rd Engin. - 1st Mate & Master	Master	13.
INDIA	Secretary of State in Charge of the Sea (SSS)	12 Y	12 Y		19	BCE & Exam	none	none	4 Y	4 Y	4 M	32	32	50 min.	School	SSS	Merchant Navy Officer Cert.	Diploma of Higher National Education	SSS	BSc Degree	14 M	46 M	48 M	32	- Deck Off. - 1st Mate - Master	Master	14.
INDIA	BCE & Department of Transport (DTp)	12 Y		DL Maths, Physical Maths, Phys		BCE	1 M	depends	Sandwich 4 Y	4 stages 3 Y	2 Y 1 Y	stage 30	35 15	50 min.	School	Dept. of Transport	Class 3 Cert.	None BSc Degree	DEC	BSc	2 Y	3 Y	5 Y	26	- Class 4 - Class 3 - Class 2 - Class 1	Class 2	15.

Table 4.1 Selected MET Systems

* Abbreviations:

Min	Ministry
Adm	Administration
Ed.	Education
MET	Maritime Education and Training
G Ed	General Education
Y	year/s
M	month/s
W	week/s
H	teaching hour/s
min.	minutes
GCE	General Education Certificate
Dip	Diploma
Bsc	Bachelor of Science Degree
Msc	Master of Science Degree
Cert	Certificate
OL	Ordinary level (UK) =junior secondary school level
AL	Advanced level (UK) =senior secondary school level
phys	physics
ave	average
mini	minimum
svs	service
dept	department
*	to be further discussed
DEC	UK Department of Education and Science
DTp	UK Department of Transport
SSS	French Secretariat of State in Charge of the Sea
KMPA	South Korea Maritime & Port Administration

Fig 4.1



(Ref. RB 5.1)

common.

The chief purpose of the MET in most of countries, as described in "The Analysis of National Training Programmes by the Joint Maritime Commission" of ILO, is "to prepare seafarers to carry out their duties efficiently in order to ensure the highest possible standards of operating efficiency and of safety onboard ship."

Apart from this, the tendency nowadays in most of the countries is moving towards providing the future seagoing personnel with more than just vocational training. It is a general belief that in today's and tomorrow's high-tech international environment, their overall professional education, following on from their formal schooling, must be broad and deep enough to arm them with sound academic knowledge, modern technology, modern concepts and modern way of thinking, together with reasonable practical ability for their future competent performance as "all-rounders" and for their career development. (This aspect will be further discussed in Section II of this chapter.)

PERSPECTIVES OF MET SYSTEM

There are two perspectives of MET:

- the supply of competent officers to operate and maintain ships; and
- to provide for future fleet management and industry know-hows.

Table 4.1 shows a generalized picture of some physical features of the MET system in 15 different countries. The countries are chosen in consideration of social system, development level, region and types of MET. (For simplification, only the deck officers' section is included.)

MAJOR TYPES OF MET SYSTEMS

Generally speaking, they can be grouped into three types, namely:

- A. Straight Line System;
- B. Sandwich System; and
- C. Dual-Purpose MET System.

They are to be separately discussed while Section D will be devoted to two case studies - one for MET in Japan, as an example of well co-ordinated national MET system; and the other for Arab Maritime Transport Academy, Egypt, as an "all-in-one" flexible example.

Ratings' training and Certification will be briefly discussed in E and F.

A. STRAIGHT LINE MET SYSTEM

This is a very popular system in line with a nation's higher educational system in other fields. Most of the countries listed in Table 4.1 are taking this form, e.g. China, Egypt, France*, Japan*, Netherlands*, Poland, South Korea, USA*, USSR, etc. (* means Dual Purpose MET program is conducted.)

The system takes the following features:

- MET is one sector of the nation's higher education umbrella.
- Students are enrolled from high school graduates.
- It is a non-stop full-time shore-based academic course (3 - 5.5 years).
- Sea trainings are done as guided on-the-job training (4 months - 20 months), which is taken as a part of whole education process.
- Successful graduates are awarded both academic diploma (Bsc degree, for example) and a ship officer's certificate, which can become a valid Certificate of Competency after the holder fulfils the required sea service.

Another form of the same type is mainly practiced in Scandinavian countries and FRG. The major difference is that the student will take 1 - 3 years of sea experience as an apprentice, as in all other fields, before he/she is enrolled for a successive full-time, shore-based academic study (3 - 4 years) to get senior officer's or master's certificate and academic degree.

B. SANDWICH SYSTEM

This system started as a kind of vocational training system, very much industry-need oriented, especially on the deck side.

- Trainees were/are usually sponsored by shipping companies.
- Academic studies are usually cut into 3 periods. After each period, students go to the sea as seafarers holding the corresponding certificate, and come back after fulfilling the minimum required sea time. This continues until they finish the last period, passing both academic and certificate examinations (Ref Fig 4.1). The UK, Norway and Belgium have used the system for a long time, but have now incorporated it into the national technical education system in recent years and are considering further reforms, i.e. conducting straight line academic courses like Type A system. (To be further discussed in II of this chapter.)

The advantages of this type of MET are:

- industry oriented, which suits the industry's immediate needs at all levels;
- the training-job gap is well bridged; and
- seafarers having gone through such process have proven to be very competent in practical professional knowledge and skills, especially in conventional types of ship operation.

Disadvantages:

- the whole MET process takes a very long time, 10 years or so.
- a weaker theoretical background and the intermittent nature of the study program has in time weakened the adaptability and capability of the so trained seafarers to meet the new technical changes and requirements.
- these seafarers have fewer shore-based job opportunities.

These two kinds of systems, by now, are familiar to the world and are just outlined in Tables 4.1 and 4.2. More detailed discussions are made on Type C- Dual Purpose MET.

C. DUAL-PURPOSE (DECK+ENGINE) MET SYSTEM

In recent years a new system of educating and training dual-purpose maritime officers, either of junior or senior rank, has emerged in a number of highly developed maritime countries, firstly in France, then Japan, USA and the Netherlands. The F.R. of Germany, the UK and Denmark are likely to follow the suit. It does represent a very radical change and a bold experiment in MET and draws a lot of attention and discussions.

It is a well-accepted notion that marine engineers and deck officers originate from two distinct human archetypes and it is difficult to mix the two in one. Then, why dual-training?

The demands, as usual, originated from the industry need to optimize ship operation through:

- better exploitation of modern technology, and possible rational manning scale. (Refer to previous discussion on the above issues.)
- better communication and co-operation among shipboard personnel to actualise safer and more efficient shipboard operations and to improve social life or human relationships through better mutual understanding.

The following briefly describes four of the existing Dual-purpose Officer MET systems or programs and their advantages and disadvantages.

(1) The Netherlands

Dutch MET has undergone four periods of evolution bringing it to the present system of training dual purpose maritime officers, which started in 1985. (See Fig 4.3) Initiated by the Dutch government and co-ordinated by the Higher Vocational Education Council, a process of voluntary merges has taken place among the then-existing 9 higher nautical institutes. As a result, 6 remain but in the very near future, only 4 will be kept to conduct the new MET program. At the present stage, training and education of mono-disciplinary officer is still in operation by means of the sandwich system, including the training of radio officers.

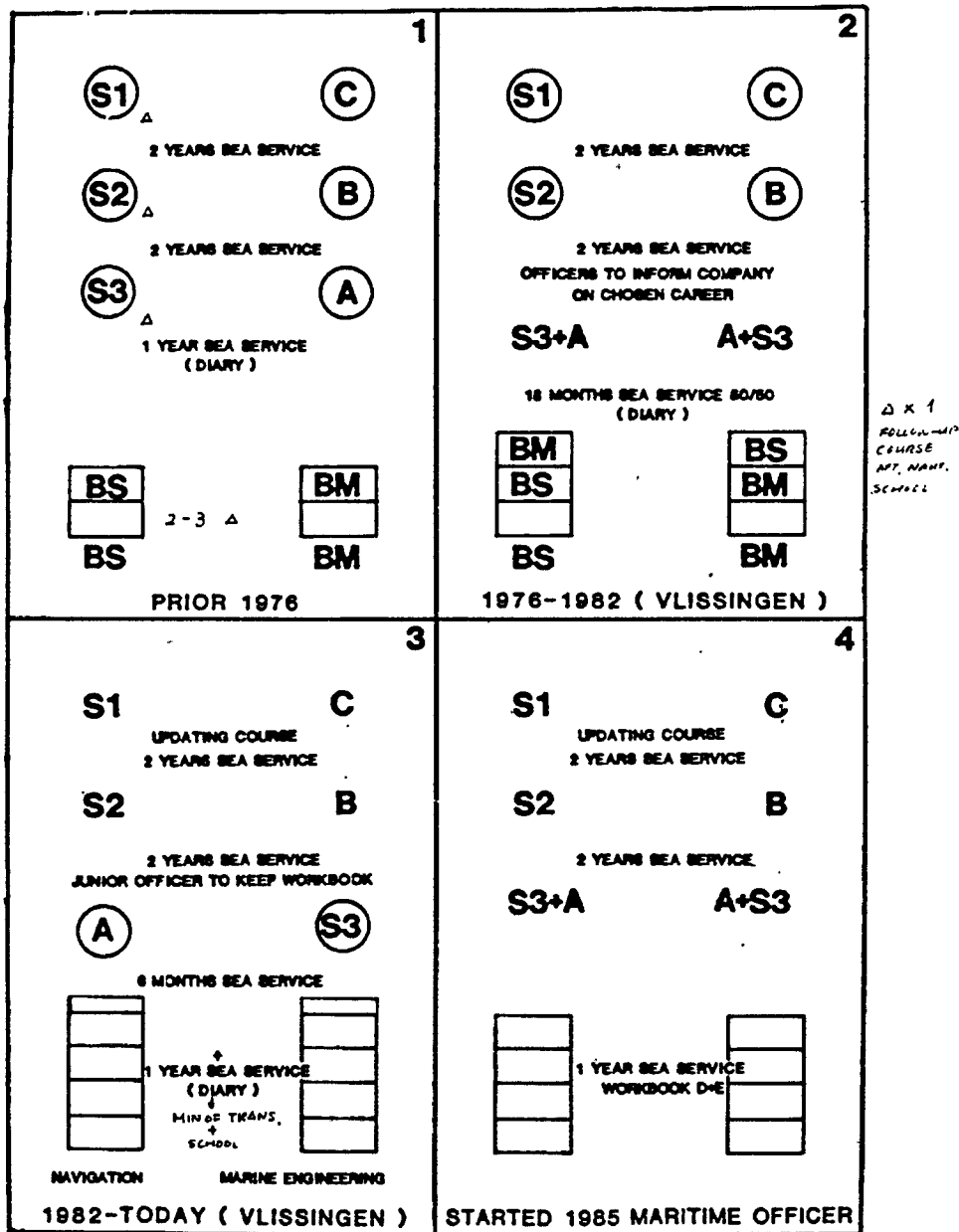
The Dual-purpose training program is a 4 year course conducted according to the syllabus based on a skill-list (job profile) co-designed by the Dutch Shipowners Association, seafarers Trade Unions and the Ministry of Transport. It includes the minimum required knowledge and abilities for future dual purpose maritime officers in compliance with STCW Convention and national legislation.

- a) During the first two academic years students undergo an amalgamated training process for both deck officers and marine engineers. General knowledge and essential basic theoretical knowledge as well as basic practical skills for both parts are taught.

The division of subjects over these two years is as follows:

Fig. 4.3 EVOLUTION OF DUAL PURPOSE OFFICER EDUCATION IN THE NETHERLANDS

EVOLUTION OF DUAL PURPOSE OFFICER EDUCATION



(Table 4.3)

	1st Year	2nd Year
- general subjects	15%	10%
- pure sciences	35%	12%
- professional subjects	18%	26%
- navigation/seamanship	15%	26%
- marine engineering	17%	26%

- b) During the third year, the students will do their sea time on board Dutch merchant ships. The trainees participate in the total shipboard operation as watchkeeping officers to acquire operational skills. It is considered to be of the utmost importance that their attention is drawn to imminent occurrences on board, irrespective whether it be on deck, bridge or in the engine room. Optimally, deck, bridge and engine room watches are stood according to the circumstances which may arise. Each trainee is to keep record in a Trainee's Work book, which contains a check list of operational skills with a number of items on which the trainee has to report and be evaluated by his shipboard mentor and submit to the institute and the Ministry for revision and approval. Should it be considered insufficient in a limited number of items concerning operational abilities, extra seetime may be ordered after final examination in the fourth year.
- c) In the final year of the study specialization is introduced enabling the students to make their own choice between Navigation and Marine Engineering for future higher certification after legally required sea time and an updating course. The education phase ends with a final examination consisting of 3 parts:

Table 4.3

Part 1 (preliminary examination)	Navigation	Marine Eng.
- Health and First Aid		
- Automation		
- Ship construction		
- manoeuvring	35%	35%
- Meteorology and oceanography		
- Practical work: Machinery, electrical engineering		
Part 2 (examination)	Navigation	Marine Eng.
- Navigation, instruments, systems		
- Passage planning		
- Cargo handling	35%	20%
- Propulsion systems		
- Auxiliary system	20%	35%
- Electrical engineering		
Part 3 Thesis	10%	10%

- d) Upon completion the graduate will get his Bsc degree and Maritime Officer Certificate (S3+A or A+S3) to start his sea career as a junior officer of dual qualification on board a Dutch merchant vessel - usually a high-tech vessel. He will work in turn with two other maritime officers sometimes on bridge watch, sometimes in the engineroom to fulfil the duty

of the conventional third officer and/or third engineer and then second officer or second engineer.

- e) After 2 years of sea service these maritime officers will obtain their higher certificates either as Chief Mate (S2) or First Engineer (B) according to their specialization done at the education phase.
- f) After another 2 years of sea service, they would attend a necessary updating course leading to Master Certificate (S1) or Chief Engineer Certificate (C).

So far, three groups of students have been enrolled and are doing their studies according to the concentrated syllabus. The Dutch merchant fleet will not see them in service until late 1989. However, based on the previous practice and experience (95 graduates trained by means of one year follow-up course from 1976 to 1981 and 140 since 1981, ref. Fig 4.4), the Dutch MET experts believe that the future dual purpose maritime officers working on board sophisticated high-tech vessels will definitely pay a positive contribution to efficient and safe ship operations and will most probably find a lot more job satisfaction aboard and ashore as well.

But, on the other hand, highly integrated/concentrated course syllabus has brought a lot of doubts and complaints from the academic teaching side. They feel that they cannot do a good job as before under the present time constraints when the allowed teaching hours are reduced by 1/3. "My students don't like me now. I don't have enough time to be very patient in class. I am also integrated!" as one of them said.

Here, three aspects must be considered:

- 1) Nothing is perfect, let alone at its initial stage. The conflicts between the old and new system will be complementary to the new in a long run. But,
- 2) will the highly concentrated two-in-one program ensure the same level of proficiency as the old when many subjects are skimmed over?
- 3) Can we cook a new kind of food with the same material and same method as always? What conceptual, material and methodological changes are implied and necessitated?

(2) Japan

In Japan, after three years of cautious and methodical experiment on board selected ships manned with 18 crew members, the DPC (General purpose ratings) and "Watch Officer" (dual purpose junior officers) has been practically and legally set up. The system was incorporated into Japanese manning regulations in 1983, which indicated the principal requirements for future training in order to meet the demands from all new ships "Highly Rationalized Ships- Type A, B, and C" as they are called (Ref. Table 4.5 and Fig. 4.4), excluding specialised ships. On board these ships the roles of the 3rd Officer and 3rd Engineer are combined hence it has become a virtual necessity for all future mariners to be dual licensed.

The courses to suit this demand are thus programed in all maritime academies. The first group will complete their entire course under this new system in 1988. Similar to the Dutch system, the "Watch Officers" include two types:

- Navigating Officer/Watchkeeping Engineer
- Engineer/Watchkeeping Navigating Officer.

This means that the course is not designed to acquire the same degree of specialized knowledge in both disciplines. It is understood that the future officers are to be trained to the prevailing Japanese standard in their specialized discipline, and to the IMO/STCW Convention standard in the second discipline.

The purpose of the dual license is to introduce flexibility into the ship management system and incorporate the possibility of further development by replacing the traditional concepts in manning ships.

This training program is available both for the newcomers to the industry and the existing officers, who are offered the training to get the certificate of the second discipline.

Other details will be discussed in D.- Case Study, MET in Japan.

(3) The United States

In the U.S. Merchant Marine Academy, the Dual License Program started in 1969. Like the other three majors offered in the academy, it is a 4-year university program with a combined curriculum, leading to a license of Deck and Marine Engineering Speciality. This program is so designed that only a well-selected group of students (40 each year) are enrolled. They are considered to be "very bright with high I.Q.s". Needless to say that the courses designed for them are very tough when they, sometimes, have to join the classes in both Marine Transportation Program and Marine Engineering Program, plus additional self-study subjects required.

Dual License Curriculum is shown in Table 4.6.

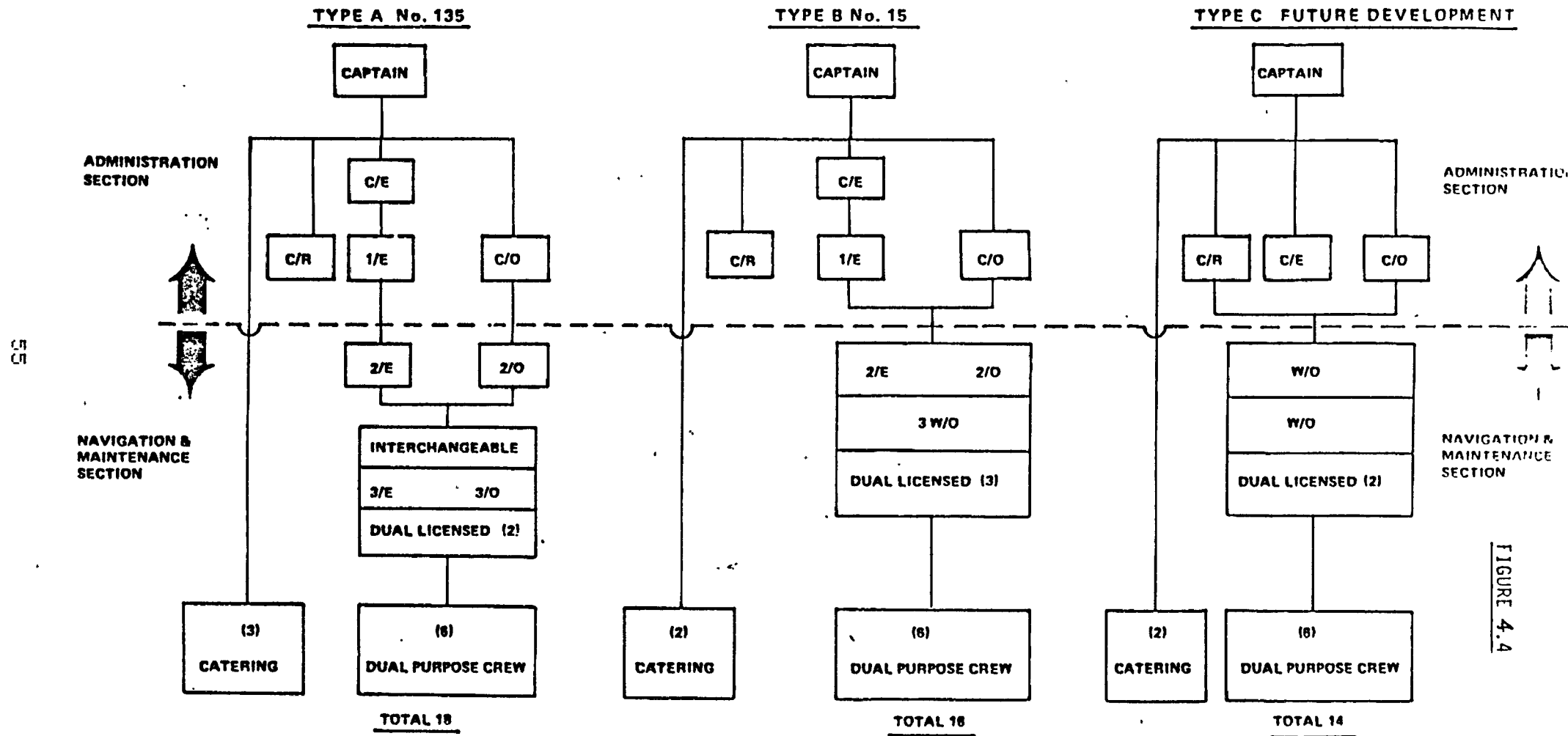
Like all other cadets (midshipmen, as they are called), their professional training is emphasized during the one year sea service. They are given a study guide called "Sea Project". In addition to performing shipboard duties, the midshipmen are required to complete written assignments which are to be submitted to the Academy for evaluation and grading. The Written assignments cover the following areas:

- navigation
- seamanship
- cargo
- naval architecture
- marine engineering
- machine shop, and
- labour relations.

The dual license majors spend half of their time in the Deck Department and the other half in the Engine Department to obtain experience in both specialities, while Deck and Engineering majors are required to complete assignments in the opposite department during the first period of the sea training to obtain

MODERNIZED JAPANESE CREW MANAGEMENT SYSTEMS (2)

EXPERIMENTAL HIGHLY RATIONALISED SHIPS (SHIP TYPES EXCLUDES ONLY GAS CARRIERS)



On 5th June 1985
 TYPE A (135) + TYPE B (15) = 150 SHIPS
 NOTE EXPERIMENT ENDED 15th July 1985

FORECAST BY 1990
 SHIP TYPE A + SHIP TYPE B = 350 SHIPS

FIGURE 4.4


Table 4.5 (A) (B)

STANDARD OF EQUIPMENT FOR HIGHLY RATIONALIZED SHIP (A)	STANDARD OF EQUIPMENT FOR HIGHLY RATIONALIZED SHIP (B)	SHIP OF THE FUTURE (C)
<ol style="list-style-type: none"> 1. Remote control device of propulsion machinery, monitoring/alarm devices for propulsion machinery and its direct auxiliaries, fitted on the navigation bridge. 2. Automatic start system of stand-by pumps of lub oil pump, fuel oil pump and cooling water pump for propulsion machinery. 3. Safeguard system of propulsion machinery against excessive revolutions and loss of lubricating oil pressure. 4. Automatic temperature control system of fuel oil, lub oil and cooling water for propulsion machinery. 5. Automatic control system of electric generating and distributing units. 6. Safeguard system of electric generating units. 7. Automatic temperature control system of lub oil and cooling water for electric generator's motor. 8. Shielded fuel oil injecting pipe of main diesel engine. 9. Automatic fire detecting device in engine room. 10. Alarm device for machineries in engine room, fitted in engineer's cabins. 11. Automatic data logging device for propulsion machinery and important auxiliaries. 12. Remote controlled level gauge and high level alarm of fuel oil tanks. 13. Power driven hatch cover handling device (pontoon type excluded), side port, rampway, etc. 14. Remote control device of mooring winches. 15. Remote control system of ballast handling on the ship necessitated to adjust heel and/or trim by ballast water during cargo handling. 16. Remote control and monitoring devices of replenishment of fuel oil or equivalent. 17. Remote control and monitoring devices of cargo handling and safeguard system on oil tanker. 18. Improved accommodation. 19. Navy navigation Satellite System (NNSS). 20. Rearrangement of provision stores onto the same deck adjacent to galley and integration of saloon and mess room for officers and crew. 21. Maritime satellite communication system. (SATCOM) 	<ol style="list-style-type: none"> 4. Remote control device of propulsion machinery, monitoring/alarm devices for propulsion machinery and its direct auxiliaries fitted on the navigation bridge. 2. Automatic start system of stand-by pumps of lub oil pump, fuel oil supply pump and cooling water pump for propulsion machinery. 3. Safe guard devices against excessive revolutions and loss of lub oil pressure of propulsion machinery. 4. Automatic temperature control devices of fuel oil, lub oil and cooling water for main engines. 5. Automatic control system of electric generating plant. 6. Safeguard devices of electric generating motor. 7. Automatic temperature control devices of lub oil and cooling water for electric generating motor. 8. Shielded fuel oil injecting pipe of main diesel engine. 9. Automatic fire detecting device in engine room. 10. Automatic devices for important machineries to be fitted in engineer's quarters. 11. Automatic data logging devices of important machineries. 12. Level gauge and high level alarm device of fuel oil tanks. 13. Power driven hatch-cover handling devices (pontoon type excluded), side port, rampway, etc. 14. remote control devices of mooring winches. 15. Remote control system of ballast handling on the ship necessitated to adjust heel and trim by ballast water during cargo handling. 16. Remote control and monitoring devices of replenishment of fuel oil. 17. Remote control and monitoring devices of cargo handling and safeguard system on oil tanker. 18. Improved accommodation. 19. NNSS 20. Rearrangement of provision stores onto the same deck adjacent to galley and integration of saloon and mess room for officers and crew. 21. System of engine control and radio operation and listening located on the navigation bridge. 22. Collision avoidance system. 23. Effective equipment necessary for watch while in port located on the upper deck. 24. SATCOM and international VHF/Facsimile. 	<ol style="list-style-type: none"> 1 One man bridge for : Navigation Track control Propulsion Telecommunication 2 Helicopter 3 Rope down station 4 Supply container 5 Free-fall life boat with radio position memory 6 Safety rudder system 7 Programcontrolled machine Integrated boiler control Improved fire protection 8 Communication center 9 Board management center (BMC) 10 Definitive plant and system reliability 11 Energy saving operating design 12 Carbon combustion for Diesel and boiler Gas turbines (gasfired) 13 Fuel analyser 14 Fuel oil treatment of future residual oil 15 Satellite navigation Satellite communication 16 Ship operation center (SOC) Bridge monitoring Engine monitoring 17 Manning 12-10 men Pilotmaning 3-6 men 18 Open engine room 19 Diagnostic and trend recording 20 All plants prepared for one man operation 21 Radar characteristics ship-ship 22 "Go to shore" by instruments from SOC 23 Standardized deckhouse for different types of ships 24 On/off board equipment (to be handled by one man) 25 Guarantee of emergency operation in case of faults 26 Extension of dock intervals 27 Manoeuvre automation Go to shore Moor Shove off 28 Antifouling 29 Remote operation of anchor 30 Reduction of propulsion energeie by design optimization <p style="text-align: center;">Asymmetrical aft body Large propeller diameter Water distribution nozzle</p>
<p>* Up to June 1985: Type A (135) + Type B (15) = 150 ships (Japan)</p> <p>* By 1990 (Forecast): Type A + Type B = 350 ships (Japan)</p>		

Table 4.4

Table 4.5 DUAL LICENSE CURRICULUM AT U.S. MERCHANT MARINE ACADEMY

Four-Year Program of Study

<p>Plebe Year (Fourth Class) Curriculum</p> <p>First Quarter Calculus and Analytic Geometry I Chemistry I English I Engineering Graphics I Marine Safety I Nautical Science I Physical Education</p> <p>Second Quarter Calculus and Analytic Geometry II Chemistry II English II Engineering Graphics II Marine Engineering I Engineering Shop I Physical Education</p> <p>Third Quarter Calculus and Analytic Geometry III Physics I Nautical Science II* Engineering Graphics III*** Marine Engineering II*** Engineering Shop II*** Naval Science Fundamentals Physical Education Marine Transportation I*</p>	<p>Fourth Quarter Calculus and Analytic Geometry IV Physics II Nautical Science III* Safety of Life at Sea I Nautical Science IV**** Engineering Graphics IV** Electrical Engineering *** Metal Cutting Processes I*** Metal Joining Processes I** English III Physical Education</p> <p>Marine Transportation Curriculum</p> <p>Third Class (Sophomore Year) Physics III, IV Safety of Life at Sea I Engineering Science Statistics Introduction to Computer Engineering History I Economics I, II Meteorology Managerial Process Naval Weapons Systems Physical Education</p>	<p>Second Class (Junior Year) Marine Materials Handling I, II Marine Electronics I Seamanship I Navigation I Accounting for Management History II, III Business/Maritime Law Naval Operations I Physical Education Elective</p> <p>First Class (Senior Year) Bridge Simulator Training Advanced Cargo Stowage and Ship Stability Marine Safety II, III Seamanship II Navigation II Marine Electronics III, IV Principles of Naval Architecture Marine Transportation II Marine Insurance Naval Operations II Maritime Labor Relations License Seminar Physical Education Option: Humanities Sequence or Comparative Sequence or Foreign Language Sequence Electives</p>
<p>Dual License Curriculum</p> <p>Third Class (Sophomore Year) Metal Joining Processes I Introduction to Computer Engineering Engineering Mechanics I, II Thermodynamics I Business/Maritime Law Economics I, II Introduction to Linear Differential Equations Physics III, IV Naval Weapons Systems</p> <p>Second Class (Junior Year) Marine Electronics I Marine Materials Handling II Seamanship I Meteorology</p> 	<p>Navigation I Strength of Materials Principles of Naval Architecture Fluid Mechanics I Thermodynamics II, III Electric Circuits I, II Physical Education</p> <p>First Class (Senior Year) Alternating-Current Machinery Marine Refrigeration Marine Engineering I, II, III Internal Combustion Engines I, II History I, II, III Humanities IV Marine Transportation Managerial Process Marine Insurance Marine Materials Handling III Marine Safety II, III Communications Seamanship II Navigation II Marine Electronics III, IV Naval Operations I, II Physical Education</p> <p><small>*Marine Transportation majors only **Marine Engineering and Marine Engineering Systems majors only ***Marine Engineering, Marine Engineering Systems, and Dual License majors ****Dual License majors only †The curriculum is subject to change.</small></p>	

basic familiarity with all aspects of ship operation.

Upon graduation, the graduates are awarded with Bsc degree and a Dual Licence of junior ship officers. More job opportunities are open to them.

(4) France

French MET system to produce Dual-purpose ship officers started in 1967, 20 years ago with main purpose of increasing mutual understanding and reducing discipline barriers among seafarers in order to improve co-operation and social relationship onboard French merchant ships. Now, it coincides with the demands for manning cut and function combination.

Different from other Dual training systems the students may take either of the two study programs.

They may start with separate streams of courses, Deck or Engine, as they prefer. This is Level II, which lasts for 3 years with 4 months sea training. Successful graduates get a Diploma of,
- Watch-keeping Officer (OCQ) for Navigation graduates or
- Technical officer (OT) for Marine Engineering graduates
and have to fulfil a 24-month (net) sea service before they can be issued Certificate of Competency as Watchkeeping Officer/Engineer.

Then, provided they pass the open entrance exam, they join the last year of Level I study - a dual purpose training program of 4 year duration.

The syllabus of Level I courses is based on and designed for the deep sea captains and first class engineer officers, including the new developments in ship technology and legislation. The first 3 years are shorebased studies and end with the exam leading to the Merchant Marine Officer Diploma for successful students, which becomes a Watchkeeping Certificate after 10 months sea service. After a total of 20 months at sea the students return to the academy for their final year of studies before they sit the exam to get the Diploma of Higher Education of the Merchant Marine, which can become a Certificate of Competency for First Class Master Mariner (C1NM) when the diploma holder has completed 46 months of sea service including no less than 16 months on deck and 16 months in the engine room. From then on they can either work as captain or chief engineer on board ships of any size.

In 1986, there were only 50 students taking the dual courses in the 2 maritime academies which offer the Level I courses. This new academic year's enrollment is less than 20, despite the fact that the industry prefers the dual purpose officers.

Another phenomenon worth noticing is that after 20 years of dual purpose education, no graduate has yet got the opportunity to work as a ship captain or chief engineer as he likes. The given explanation is that the fleet is shrinking. Fewer vacancies are available. They have to wait for their turn like other traditionally trained officers...

(5) Advantages and Disadvantages of This MET Approach

Apparent advantages and disadvantages of this new approach of MET is summarized in the Research Project Report (RB 1.I, 2.4 4/87):

Advantages

1. Better understanding of the ship as a total system.
2. Better understanding between the disciplines on board.
3. Basic technical skills will be held in time by all officers.
4. More flexible deployment of officers becomes possible.
this will allow a reduction in the number of officers carried and a wider distribution of duties to reduce the likelihood of fatigue.
5. Better understanding of the ship's working environment.
6. Greater interest through wider variations in work content.
7. Better skill fit with integrated ship systems.
8. Rational step for ships with new technology.
9. Compatible with international conventions on STCW.
10. National scheme does not inhibit use of personnel in single disciplines by individual companies.
11. Pending development of ab initio dual training the conversion of existing watchkeepers to dual role is possible.
12. Overcomes some problems of mismatch with shore employment for deck officers.

Disadvantages

1. Need for rationalization of depth of theoretical treatment for specialist subjects.
2. Need for rationalization or extension of periods of practical training.
3. Need to provide an onboard work regime to keep all skills active.
4. One skill may lapse and need to be recertified if insufficient ships operate a dual certificate system.
5. A national scheme requires collective agreement.
6. Need to overcome some prejudices from existing traditional trained incumbents.

Generally speaking, this "new" practice seems a desirable development for the present advanced-technology and high-labour-cost fleet, which is in tune with the need to operate modern technology to best advantage and reflects a growing view of questioning the necessity and desirability of the traditional strict demarcation between deck and engine against the trend towards modern high technology shipping.

D. CASE STUDY

(I) MET SYSTEM IN JAPAN

It seems to be the modern life philosophy or life principle in Japan to always keep alert and try all means to remain ahead. There is no exception in the field of its MET, which forms a part of the whole process of implementing a broad based policy towards maintaining its position as a major maritime nation.

Apart from its well-known huge efforts and investments on technological research and development, it is worthwhile to notice its MET system, which is apparently so well-woven and harmonized or co-ordinated to provide various opportunities for and meet the demands from all parts and all levels. Fig. 4.5 shows a schematical diagram the various ways of becoming merchant/fishing ship officers and ratings. (Source: 1.H-3)

Significantly the system operates in an industrial environment where all seafarers are represented by one union, and is firmly anchored to the general education in that country. (Ref. RB 4.10 and Fig. 4.5, Table 4.7)

These figure and table provide us with a clear general outlook of the whole MET system in Japan. Within the system there is room for 4 branches, namely:

1. Mercantile Marine Universities:

- university education in nature
- enrollment from senior high school graduates with common university entrance examination
- in addition to ship operation fundamental research is included in most aspects of marine transportation
- graduates are not only made aware of the developments and potentialities of new technology but actively participate in the research involve since these universities have close links with the shipbuilding and marine electronic industries. This enables the system to initiate development from within.

2. Mercantile Marine Technical Colleges:

- vocational education in nature
- enrollment from junior high school graduates
- mainly stresses on practical ship operation
- students can change over to a university after a period of 3 years (equivalent to senior high school graduates).

3. Marine Technical College:

- professional re-education in nature
- enrollment from seafarers
- provide training and education to enable seamen to obtain certificates of competency as ship officers
- provide refresher and revalidation courses for existing ship officers to update their knowledge and skill
- provide correspondance course for sea-going mariners
- provide training for existing officers and ratings for obtaining the dual qualifications necessary to work as watch officers and dual purpose crew (DPC) in "Highly

Fig. 4.5 Mercantile Ship

Fishing Ship

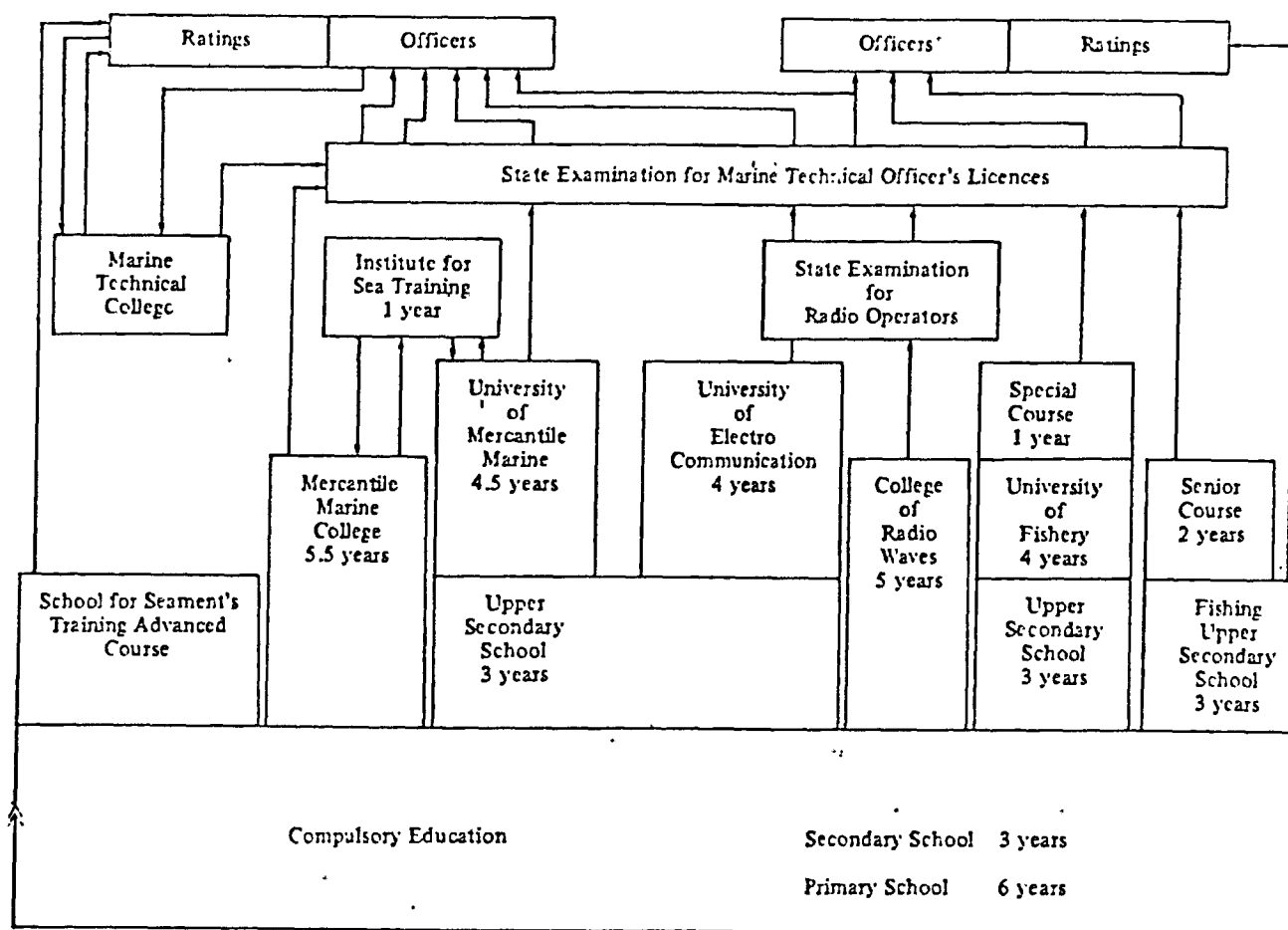


Table 4.6 D. INSTITUTIONS FOR EDUCATING SEAFARERS IN JAPAN

At present the existing educational institutions for seamen are shown in the following table:

Seafarers educational and training institutions by competent authorities

Authorities concerned	Name of institution	Number	Intake
Ministry of Transport	Marine Technical College	1	3,130
	Institute for Sea Training	1	1,034
	School for Seamen's Training	10	730
Ministry of Education	University of Mercantile Marine	2	280
	University of Fishery	1	120
	Department of Fisheries in national universities	2	310
	Department of Oceanography in private universities	1	200
	University of Electro Communication	1	60
	Junior College of Electro Communication	1	100
	Mercantile Marine College	5	600
	Radio Technical College	3	160
Ministry of Agriculture, Forestry and Fisheries	University of Fishery	1	200
Prefectural offices concerned	Fishing Upper Secondary School	48	about 4,080

Rationalised ships, Type A, B, and C".(Ref. Fig. 4.5)

* As for training of dual-qualification Watch Officers and Dual Purpose Crew (DPC), please refer back to I. C of this chapter.

4. Schools for Seamen's Training:

- vocational high school education and training in nature
- enrollment from junior high school graduates
- provide advanced courses designed to bring up potential leaders of medium standing among crews of ocean-going vessels
- provide hometrade officers courses
- provide steward course.

* Institute for Sea Training (IST):

- an organization attached to the Ministry of Transport
- purpose: to provide sea training for marine students of various maritime institutions to instill proper mental attitude, to teach various shipboard skills and to practise their classroom knowledge, etc.
- 2 turbine, 2 diesel training ships and 2 large sail training ships are in full service at the IST.

While it is a modern system, it retains some traditional features from the past that are considered necessary to cultivate "qualities such as adaptability, discipline, sense of responsibility, determination, endurance, spirit of co-operation and international mindedness", elements considered indispensable in a seafarer's outlook. This is the justification for retaining training under sail.

The purpose of the training onboard sail vessels is to train the students in manoeuvring large sailing ships but to impart the attitudes and abilities required of merchant marine officers.

The underlying philosophy is that:

Powerful machine-driven vessels sometimes tend to overcome nature, while a large sailing vessel will adapt herself to the environment as she proceeds on her way. And, of course, this is the essential way to maintain safe operation of the ship. Differing from the machine powered training ships, the large sail training ships cannot proceed safely without the participation of every student.

This type of training and living onboard a sailing vessel, added to normal training onboard a machine powered vessel, can therefore foster and strengthen the following attitudes and abilities required for future competent performance of a ship's officer:

- Full knowledge of his trade and skill in its practice;
- Persevering power of attention to watch out for all potential dangers and ability to rise to the occasion;
- Highly cultivated spirit, developed physical strength and powers of execution;
- Fraternal and co-operative spirit and leadership through living with and participation in group activities;

- Strong sense of responsibility, strict observance of punctuality and moderation;
 - Sense of sanitation and well cultivated habits of cleanliness, neatness and tidiness;
 - Getting accustomed to an international way of thinking and acting, etiquette and manner, and well developed prudence and accomplishment.
- (Ref. RB 1.H-3 & 4; RB 4.10 and visit to Seiun Maru)

The Japanese MET system, like others, has been developed to suit its particular needs. Nevertheless, it is a well-coordinated system since it does have both stability and the flexibility to accommodate change brought about by changing circumstances.

(II) ARAB MARITIME TRANSPORT ACADEMY (AMTA), EGYPT
(A brief description of its features)

As a well-established maritime academy, AMTA has several special features and strong points that are worth referring to. These include:

1. Strict academic disciplines and flexible study possibilities and opportunities

Academic disciplines will be discussed in later chapters. Here the stress will be laid on its reknown academic program flexibility, which provides different levels and different modes of study possibilities to different needs from industry and individuals according to their experience, ability and expectation.

Academically, there are 8 departments and training centres:

- Department of Nautical Studies
- Department of Marine Engineering Studies
- Department of Radio and Electronics
- Department of Academic Studies (running basic and general science courses including The Common First Semester for all the cadets)
- Department of Maritime Studies
- Sea-training Department
- Seamen's Training Centre
- Marine Cater Training Centre

In the 3 sea majors, the academy offers more than one program of different levels and modes. Taking the Nautical Studies and Marine Engineering Studies as an example we see:

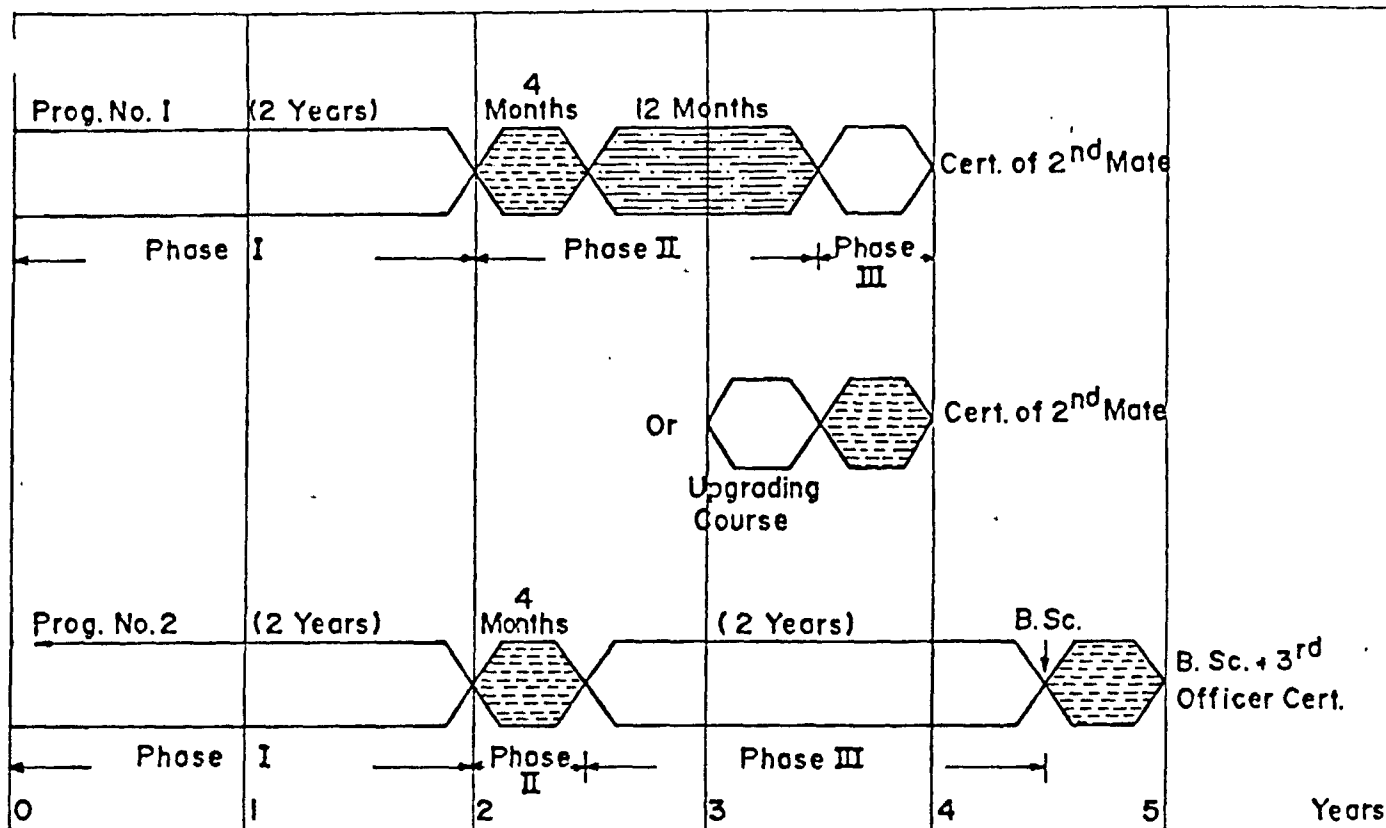
Two programs for academic studies are available, plus one Upgrading Course program. (Fig. 4.6) Take Nautical Studies:

Program 1 (A):

- 1) 4 semester academic courses
- 2) - 4 months guided sea training
 - 6 months guided sea service on board foreign-going ships
- 3) 1 semester study in the Academy to complete the whole program leading to the Certificate of Nautical Studies and to prepare for the examinations of 3rd Mate

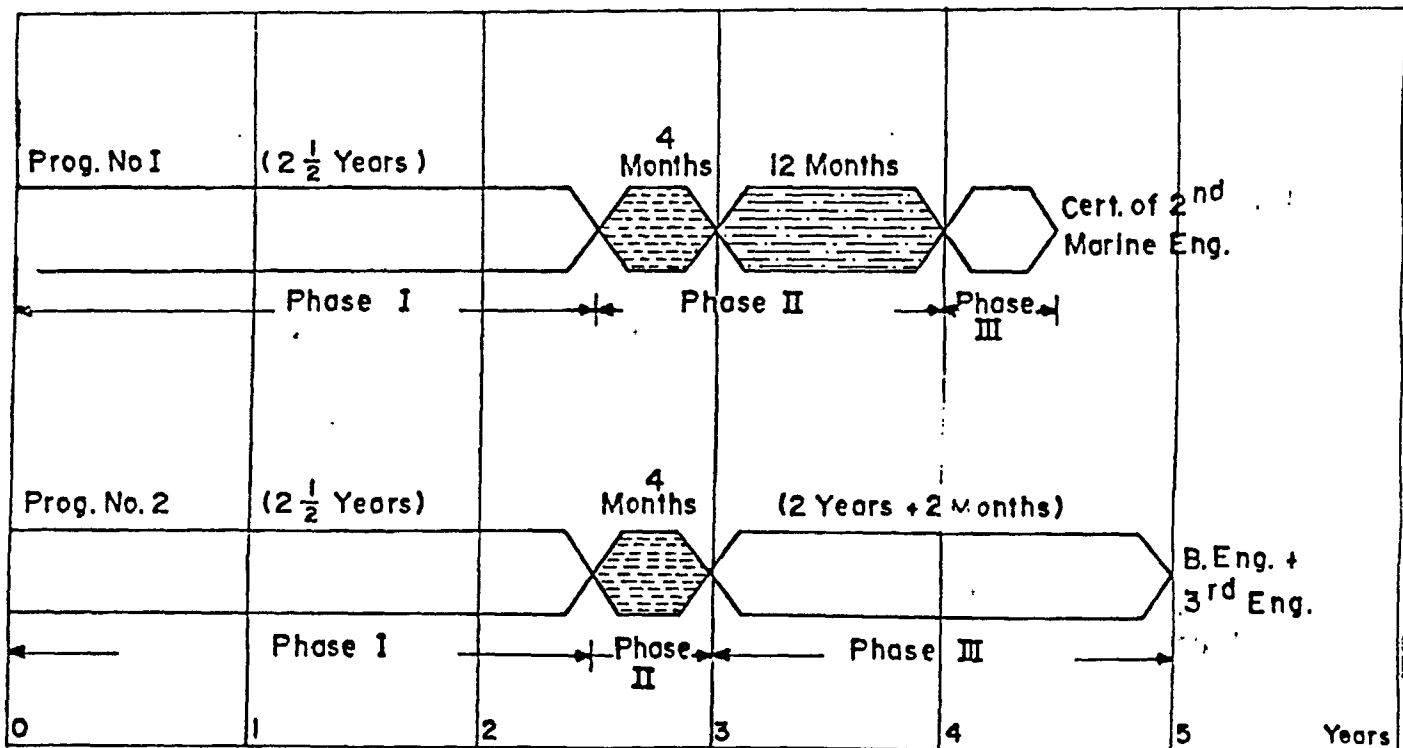
Fig. 4.6 PROFILES OF PROGRAMS - SEAFARERING SPECIALITIES

PROFILES OF PROGRAMMES - NAUTICAL STUDIES



□ Study of the Academy ▨ Guided Sea Training ▩ Sea Service

PROFILES OF PROGRAMMES - MARINE ENGINEERING STUDIES



Certificate of Competency.

Program 1 (B):

- 1) 4 semester academic courses
- 2) - 4 months guided sea training
- 12 months sea service
- 3) 1 semester study to complete the whole program leading to the Certificate of Nautical Studies and to prepare for the examinations of 2nd Mate Certificate.

Program 2:

- 1) 4 semester academic courses
- 2) 4 months guided sea training
- 3) 4 semester academic courses leading to Bsc degree + 3rd Officer Certificate
- 4) 6-12 months sea service to get Certificate validation.

* Graduates of Program 1 or the ship officers with equivalent qualification can join in the third phase of Program 2 at any suitable time.

Upgrading Course Program:

(For deck officers and individuals who have completed the required sea-service periods to prepare for examinations for certificates of competency)

- 3rd Mate - 3rd Engineer
- 2nd Mate - 2nd Engineer
- 1st Mate - Chief Engineer
- Master

* Other specialized courses.

* Msc Degree courses are also available in some departments for further academic development of qualified students.

2. Apart from the conventional teaching facilities and resources, an Information and Microfilm Center and a Maritime Research and Consultation Center (financially independent) are also operating under the same administration.

The Information and Microfilm Centre collects, processes, analyses and provides information, data and some documentation for the needs of three levels:

- the Academy's departments
- the whole Academy (internal administration)
- the whole Maritime Transport Sector of the country and region.

The Maritime Research and Consultation Centre provides consultancy service and conducts research projects for the whole maritime sector. These activities not only establish a mutual-beneficial link and close co-operation between the academy and the industry, but also combines the know-hows and encourages knowledge and expertise sharing and exchange.

3. Active international co-operation

The Academy has close co-operating or collaborating relationship with around 30 international, regional and other foreign organizations, institutions and maritime academies.

**

All of the above three features of the AMTA enables an efficient and effective interchange and exchange of information, knowledge, expertise and know-hows among the faculty and throughout the whole maritime sector. Very exemplary, indeed.

E. MET FOR RATINGS

MET for ratings varied greatly according to country and region. These differences are obviously rooted from different traditions and philosophical approaches to the seafaring vocation.

Most of the traditional maritime countries and their former colonies used the old method of learning-on-the-job, while other countries including COMECON countries have formal vocational training schemes either in shore based seaman schools and training centres or on board training vessels, or both.

Later on, along with the increasing safety and operational requirements for better trained and qualified crews, rating's training started to be formalized almost everywhere, either as industrial training or as vocational education.

- Trainees are usually enrolled on finishing their junior high school education.
 - Three categories of pre-sea training courses are provided:
 - a) Basic General Subjects similar to those of senior high school education
 - b) Basic professional knowledge and general workshop practice such as ships' machinery, including reading of diagrams, navigation, rules of the road, visual communication, basic seamanship, basic marine technology, ships' maintenance work, etc. according to the shipboard departmental requirements
 - c) Safety Courses according to IMO/STCW requirements:
 - Safety at sea
 - Fire prevention and fire fighting
 - Life boat drills
 - Personal survival at sea
 - First aid
 - etc.
- plus short sea training or shipboard practice.

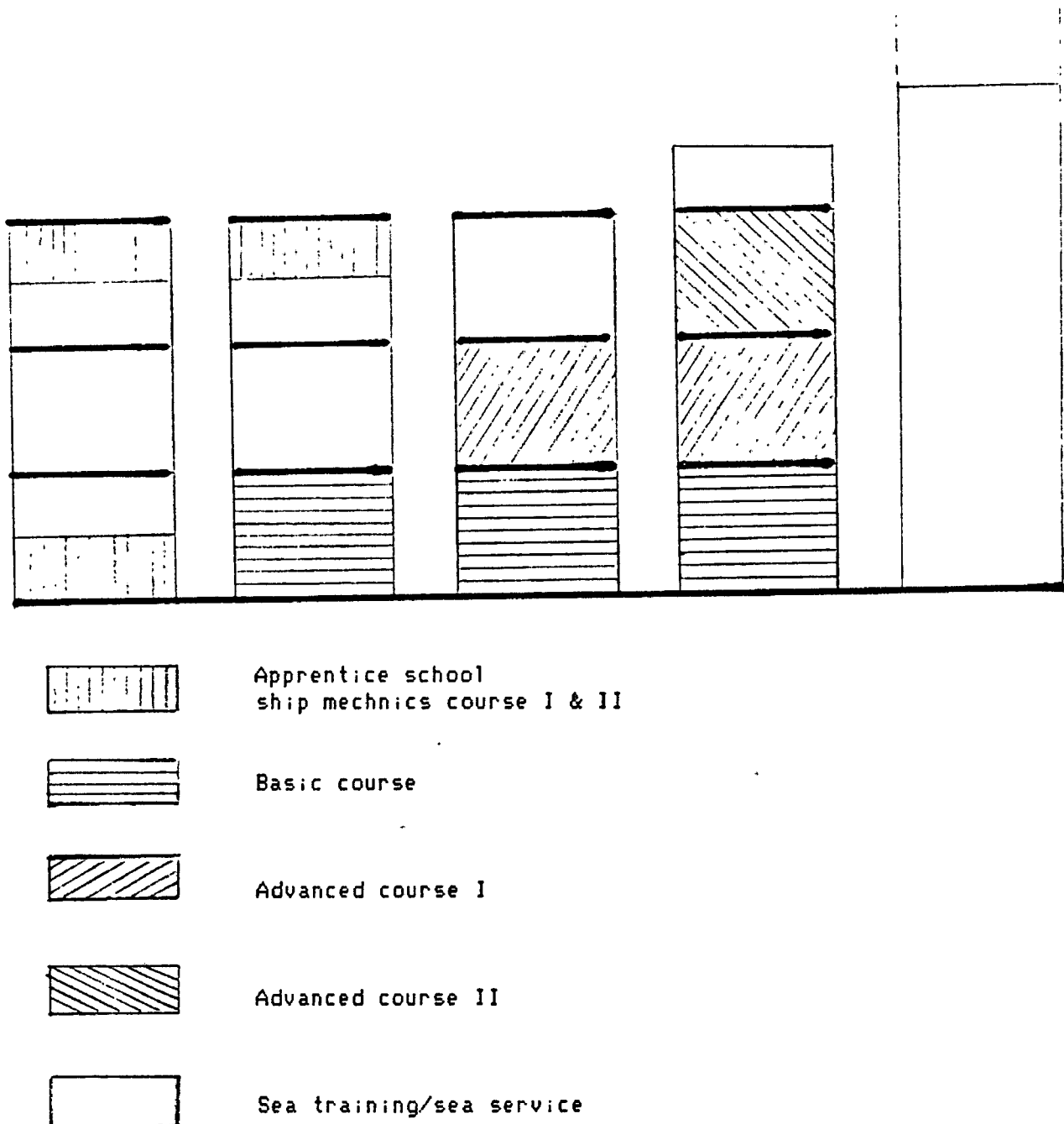
However, changes are still going on. Structural changes and technological development in ship operation, and the increasing demands for overall operational efficiency have brought the issues of manning reduction and quality enhancement into the limelight. Traditional distinct roles of deck and engine room ratings in ship operation are no longer deemed appropriate and there is less and less doubt of the necessity to remove departmental barriers and upgrade the quality of recruits and to train them in a wide range of engineering and seamanship skills so that they may be fully effective in the running and maintenance of the modern ship on deck and in the engine room. To train and man the ships with General Purpose (GP) ratings have now been widely implemented in developed countries' fleets.

GP ratings are given more comprehensive training in overall ship technology and skills to fulfil more responsible functions and duties on board with increased possibility of career development. This is based on the fact that consideration has also been given to providing the more able persons with a ladder of advancement to progress to officer level through their career practice and upgrading courses designed for same.

For example, in Norway, a 3-year training course for "Ship's Mechanic" has been introduced for years to partly replace the previous shipboard apprenticeship. Students are taken in after their 9 years general education and are trained to work on board as a kind of skilled technician in shipboard operations team comprised of officers and several ship mechanics.

This is much in line with French thought which believes that in the future there will be no sailors on board ships but technicians instead.

Fig. 4.7 Various Training Schemes for Ship Macheinists (Norway)



F. CERTIFICATION SYSTEM

Ship officer certification and examination systems take different forms but are common in nature in most of the countries. (Ref. Table 4.1)

- Authority in charge of certification
(See Table 4.1)
- Certification requirements:
 - at least in compliance with the minimum standards stipulated in IMO/STCW Conventions and incorporated within the national legislation.
 - passing the corresponding examination after the available upgrading/ MET academic courses
 - fulfilling the minimum required sea time at each level
 - medical fitness
 - renewal on application at the time of certificate expiration (usually every 5 years) after the up-dating course required thereof
- Examination Body
Usually it is a "State Examination Committee/Board of Examiners" appointed or under the supervision of the Ministry of Transport as is the case of the Netherlands and many other countries. The committee usually consists of retired ship officers, teachers from maritime academies, and other maritime experts as well as lawyers. They work under the Ministry, in charge of examination papers, compiling questions, examination supervision/evaluation and controlling the issue of the certificates of competency.

Nevertheless, the certification system is more than this. The key point is to ensure the competency of seafarers in performing their duties in shipboard operation. It is expected to be complementary and facilitating for the qualitative development of the industry; not restrictive or hampering. Facing the changes and development in all relevant aspects, the certification regulations and practice should be timely and sincerely adapting itself to reasonable and potential needs. Many reasonable appeals have been made for serious revision and up-dating of the existing national certification regulations, syllabuses for examinations and the criteria for certificates, even the provisions of the STCW Convention, which was made about 10 years ago.

Other criticisms are addressed towards the examiners' qualifications viewing the fact that many of them have long since left the sea and lack the knowledge and real understanding of modern ships, modern ship operations and their problems and requirements. for the competency of seafarers.

Another issue being constantly discussed is the co-ordination between MET institutions and the examination bodies. General subjects being examined such as mathematics, physics and law, etc. could be better handled by people teaching th subjects everyday, couldn't it?

Delegation of certain examination duties to the MET institutions has already been done in several countries. What is more rational, however, is still being discussed.

II. CHANGES AND TRENDS

Challenges and dilemmas that most of the traditional maritime countries are facing include:

- firstly, to keep a balance between the need to reduce manning levels, by taking advantage of the continually evolving advances in technology, and the need to develop their respective MET schemes that will attract sufficient numbers of people to seafaring professions and provide them with the skills and knowledge needed to operate ships safely and effectively.
- Secondly, on the one hand more sophisticated ship technology and safe, efficient operation need more qualified seafarers of high calibre, while on the other hand it is very hard to convince young people of their career prospects and potential self-development in a shrinking industry in their part of the world;
- thirdly, efficient and safe operation and maintenance of a ship needs expertise and experience as well as dedication and a sense of responsibility and economy. Studies however, have shown that on average a seafarer will remain at sea for only 8 years before leaving seafaring for good. With such a high turn over and reduction in entry to seafaring, shipping industries are in some way losing their guarantee for the appropriate number of persons with the right qualifications for present and future development as a whole;
- last but not the least, modern MET requires higher investment in teaching equipment, e.g. computer labs, simulator labs, fire-fighting centers, etc., which cost millions of dollars, while the quick reduction of willing trainees makes financiers doubtful and educators embarrassed about the cost-effectiveness of such high investments and their upkeep both in terms of the equipment and expertise.

All these challenges and new demands evolve and involve many conceptual and structural changes in the MET field. Some of them are quite fundamental. The outcome will be a new generation of well qualified maritime personnel for ship and shore to commit themselves to safer and more efficient ship operations, qualified shore management and other activities.

The following measures are taken from the governmental level or local authority level and MET institution level:

(A)

1. National MET rationalization

Calling for the elimination of the duplication in equipment investment and the wasteful competition among MET institutions for the limited number of potential students and to encourage sensible voluntary merges and the concentration of scarce resources rationally for a more efficient utilization to meet actual requirements. In West and Northern European countries 1/3 to 1/2 of the previous MET schools or academies has already been closed down, amalgamated or have diversified to other education fields. This will continue until only a sufficient number remain to run fully and efficiently to meet the national and possible international

needs.

2. Making greater use of national education system in order to ensure high levels of competency both in terms of intake and outcome.

As indicated previously, most maritime countries have already channeled MET into their national education systems either as a part of polytechnic level education (West and Northern European countries) or university level (China, Egypt, Japan, S. Korea, Poland, USA and USSR, etc.).

The same enrolling standards on the basis of general education are required and same level/depth of education are designed and provided for the same academic degree/diploma to be awarded at the end of the program.

Most countries also offer the MET a higher budget, e.g. free tuition, accomodation and subsidy for uniforms and food. The countries which do not offer such have gotten lots of complaints and appeals from both industry and education circles aiming to keep competitive and attract more high calibre students.

Academically, MET are able to share teaching faculties, equipment, laboratories, libraries and other resources available in the polytechnics, universities or nearby research institutions and training centers, which provides a better environment and greater possibilities for MET activities.

Apart from constant revision of syllabi and curricula, and increasing investment in teaching equipment, training methods based on sound education principles are being designed and innovated to develop high calibre personnel who will become competent seafarers, diagnosticians and managers.

3. Adapt the MET activities to the changes and needs

Facing the drastic drop of intake (e.g. U.K.- from 1,500 yearly in early 1980s down to 300 in 1986 and even fewer this year), MET academies or departments within polytechnics are scrutinising and justifying every activity and seeking to use the existing resources effectively. Many are directing their efforts to the recruitment of overseas students, undertaking research projects and the development of new courses, e.g. offshore courses, VTS courses, shipping economy and management courses, short refresher/upgrading courses, updating courses and special courses such as LNG/LPG tanker operation, carriage of dangerous goods, etc.)

4. Restructure of MET programmes

In view of the fact that all sophisticated, costly vessels demand new skills and expertise in operation and maintenance done by fewer numbers of appropriately qualified people, the shipping industry will need to attract high calibre young people by offering a long-term career prospect. This demands an MET programme to be broad enough in subject content and long enough in time to form a sound base for the graduate to develop and meet the requirements for a range of job opportunities, both afloat and ashore and to have the

adaptability for new changes and development in his/her field.

Furthermore, a seafarer so educated and trained would be better prepared for employment ashore where advantage would be derived from his/her initial education supplemented by those unique qualities of independent thought and action which are developed at sea.

Recently, a new proposal was made for a revised system based on the job function for ship operations and management. Only two levels are required at officer level with respect to certification:

- one level for all Ship Operation personnel;
- one level for all Ship Management personnel.

The following is the suggested course subjects: (RB 2.8 40/86)

Table 4.8 New Course Proposal (Singapore)

Total Ship Operations

Subjects to be covered (Outline only)

Module 1—Ship construction and design

Builders and owners responsibilities. Approval by Administration and Classification Soc. Design procedures and practice. Materials, use and limitations.

Module 2—Ship Safety

Safety Administration. Specification for life saving and Safety equipment. Practices in equipment use. Safety awareness and control.

Module 3—Pollution Control

National and International Legislation. Specifications for pollution control equipment. Health and Sanitation. Combating pollution.

Module 4—Ship Maintenance

Principle of maintenance. Techniques of condition monitoring. Trend analysis and maintenance planning. Shipboard Surveys (continuous). Principles of wear and corrosion control.

Module 5—Ship Handling

Navigation and position fixing techniques. Ship dynamics and manoeuvring. Collision prevention and Traffic management. Passage Planning. Berthing and docking.

Module 6—Cargo care and handling

Ship stability and stress considerations. Cargo segregation. Handling systems. Procedures and practice. Cargo monitoring and inspection.

Module 7—Communications

Elements of communications. Methods and technology available. Security and practice. Ship—Shore linking.

Module 8—Man—Machine Interfacing

Principles of ergonomics. Information transfer techniques. Stress factors. Work science.

Total Ship Management

Subjects to be covered (Outline only)

Module 1—Maritime Transportation Law

Liabilities. Charter Parties. Salvage and Arbitration. Insurance

Module 2—Maritime Transportation Economics and Safety

Codes of practice. Ship and Cargo brokerage. Conventions in operation. Classification of hazardous and dangerous goods.

Module 3—Environment Protection

Codes and conventions. Control procedures. Records and documentation.

Module 4—Developments in Maritime Technology

Energy conversion systems. Ship handling and control systems. Cargo transshipment. Ship design and construction.

Module 5—Techniques of Total Resource Management

Principles of Corporation Management. Defining and evaluating goals. Value Analysis. Resource availability and maintainability. Preventive maintenance techniques. Documentation.

Module 6—Search and Rescue

Distress and assistance communications. Ship communications equipment and systems. Search and rescue manual. Medical assistance facilities and systems.

Module 7—Personnel Management and Human Relationship

Working conditions. Labour organisation and union. Human interaction and performance.

Module 8—Accident investigation

Legislation and regulations. Procedures and evaluation of evidence. Human factors in accidents. Remedial actions.

Module 9—Ship Survey and Inspection Requirements

Influence of conventions. Role of administration and classification surveys. Technical regulations. Principles of continual survey.

Module 10—Damage Control and Integrity Maintenance

Special ship construction requirements. Safety and fire prevention. Emergency procedures. Ship evacuation.

Module 11—Applications of Information Technology

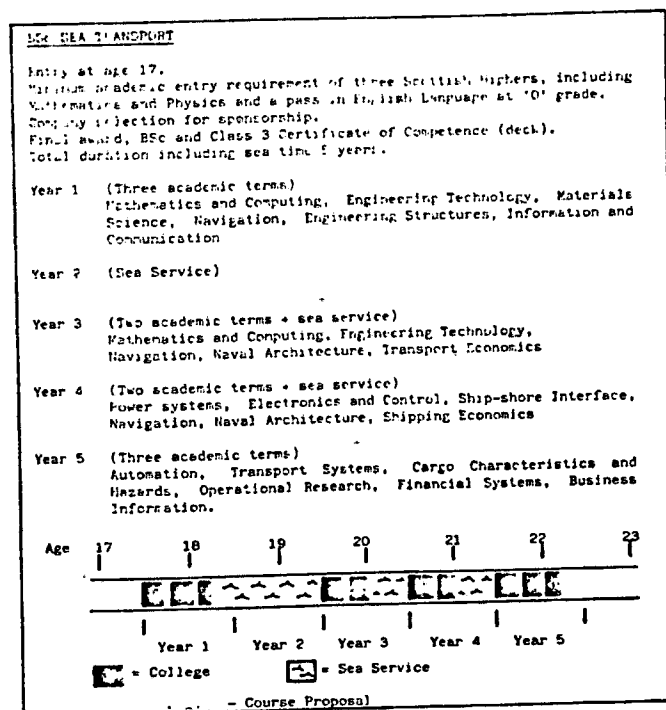
Aids in management and record keeping. Data display systems. Data transmission and communications. Computer technology and applications.

As for middle level seafarers training scheme, it is usually re-designed as follows, (not excluding the multi-purpose/GP ratings' training previously discussed):

- one/two years full time scheme (to solve the two practical training problems - lead time and costs to the sponsors (shipowners, in many countries)
- with the possibility of providing exemptions from certain statutory examination requirements
- the courses are designed to be of sufficient breadth/flexibility to provide on-going study in some appropriate maritime sphere.

There is another school of thought from pure ship operation point of view that there is no such need to devote great efforts and many teaching hours on basic science subjects such as mathematics and physics. The key point is to enroll right calibre/type of young men/women with high retrainability, to train and educate them in a 2-3 year full-time program and to keep them retrained whenever the need arises. In this way the initial MET cost is less than university or polytechnic level with shorter duration. On the trainee's side he/she will not feel frustrated to find him/herself overeducated or under-utilized vis-a-vis his/her daily routine on board, and he/she will adapt him/herself to the new technological requirement through the short courses since he/she has the potential.

Fig. 4.9 New Course Propose (UK)



(B)

Knowledge Structures, inter alia Syllabus and Curriculum

It has already been generally accepted that the knowledge structure of a qualified future seafarer must be sound, wide and well-designed to cope with the three very basic immediate and potential needs:

- a good understanding of the whole modern ship system to ensure a professional performance;
- ability to adapt to new conceptual and technical change;
- adaptability to careers other than seafaring, and the capability for higher academic advancement.

MET syllabi for the future, it is believed, ought to be formulated in such a way that future seafarers will benefit from a balanced curricula having a better knowledge of electronics, automation controlling principles, a good general knowledge of computers - especially data interpretation - and the ability to compile information in a computer-ready format. Furthermore, a better understanding of law, economy and management skills, etc. are envisioned. Subjects such as maritime law, shipping economics, shipboard management, computer technology and automation are to be a basic must just as navigation, engineering and seamanship subjects are.

From the viewpoint of the need for a better fundamental scholastic ability of future shipboard personnel, subjects such as mathematics, physics, electronics and computer science are deemed necessary for without these the operation principles, potential and limitations of modern shipboard technology cannot be very well appreciated. Moreover, adaptability of shipboard personnel to new developments in technology and to the use of new equipment will be facilitated by a thorough education in science with its long-lasting validity. (Ref. RB 4.12)

- Common-first-year or common-first-phase is already practised in many major maritime academies of US, UK, Norway, Japan, USSR, West Germany, Egypt, etc. including the countries which run the Dual-purpose Officer courses. The new cadets/freshmen have the basic introductory courses and some other general courses together in the first phase of their study so as to have a basic general overview of the field before they choose their major (deck or engine, or other similar major, if available). The final control of proportion is done by the academies according to their respective long term plans.

In the later studies, the weighing of the knowledge about the other discipline is also increased especially in the fields where they will share the functions and responsibilities. (Refer to Section II of Chapter 3).

- The general attitude is to take every opportunity, wherever it is practicable, to educate and train cadets of each discipline together. The basic belief is that modern ship design and operation have already brought the two disciplines closer or even to combine their functions to a certain degree. Reduced manning requires more team work and co-operation based on the real understanding of the whole system and the open-mindedness of the team members.

- Navigation training as a syllabus subject

Navigation itself has already been reduced from the most important subject to one of the three major subjects. The other two are seamanship - a combination of subjects dealing with the safe and efficient handling of ships and their cargoes - and maritime law. This is the natural adaptation to the technological changes in navigation which has reduced the workload with regard to manual calculations in navigation on the one hand and to the increase in carriage of dangerous and hazardous cargoes by sea and the raising of pollution prevention requirements, which have made seamanship and maritime law more important than before.

The use of satellite navigation and other navigation aids has raised doubts whether a thorough understanding of navigation calculations is still necessary when sufficient information can be obtained by few keyboard strokes.

Within the navigation syllabus which traditionally consists of terrestrial, celestial and electronic navigation, greater weight has been given to electronic navigation plus more attention to mathematics, physics, electronics and the use of computers as the basis for electronic navigation as well as technology-influenced seamanship.

However, to what extent and in what detail nautical students should understand how electronic navigation equipment works has been an on-going discussion. One school advocates that a thorough comprehension of the internal operation of the equipment is needed for maintenance and repair of electronic navigation devices; while the other school believes that a good understanding of input-output relationships plus general understanding of the principles and the whole system is required. They hold this belief because the increased reliability of modern navigation equipment and increase in equipment and function redundancy that overlaps possibilities for position finding make the maintenance and repair work less necessary. It is the navigation procedures and interpretation of read-out that should be stressed as well as associated decision-making.

In general, modern technology has brought nautical and engineering officers closer together. Nautical personnel must be equipped with sound engineering principles to cope with a more engineering oriented type of navigation work and overall ship operation.

- Marine engineering as a syllabus subject

New technology keeps being added to the traditional syllabus, based on abundant and sound basic scientific knowledge. Automation, system engineering, electronics and applied computer science are becoming more predominant and gradually penetrating all the traditional engineering subjects which in turn gives them a whole new look. Operation Economy and Operation Engineering become a must for the most sensitive issue - fuel economizing, in the worldwide campaign for running cost reduction.

More than ever trouble shooting (machinery diagnostics) and maintenance knowledge and skill are stressed in the interest of the whole system operation. Future marine engineers will be trained to be able to use more and more sophisticated condition monitoring and diagnostic equipment on board new ships rather than doing the traditional overhauling tasks with spanners and gauges.

For junior level training, more navigational knowledge is added to provide the students with a good understanding of the shipboard system relationship and to encourage an open-minded attitude/personality for the needs of the co-operative world.

For future job opportunities and career/academic progress, the syllabus is moving closer to normal industry engineering with the stress on the ability to cope with latest technology in engineering, both at sea and ashore.

- Radio Officer

The introduction of INMARSAT and GMDSS is undoubtedly a fundamental change/revolution in maritime communications, which is so vital for a safe, economic and efficient ship operation. The likelihood of abolishment of Morse code after 1990 and the comparative simplification in future maritime communications has already resulted in fewer potential willing trainees and willing employers. The previous MET programs for ship radio officers have either been closed or combined with other allied courses to prepare students for shorebased careers or ship electronics officers, who are expected to be in charge of electronic equipment maintenance throughout the ship. However the latter is facing strong arguments as to whether there will be a real demand for higher qualifications in maintenance and repair of shipboard electronic equipment since the reliability of the systems has been considerably improved and maintenance and repair functions have been facilitated.

- Refresher/Upgrading Courses & Updating and Other Short Courses

The deployment of new technology and reduced manning, together with the effort that IMO member states will pay in implementing its conventions will bring to the MET institutions worldwide a large retraining job. To anyone conscious of advances in technology, procedures and regulations, the need for short courses to bring seafarers up to date and to keep them that way is quite obvious.

Quite a number of various retraining schemes are already available and more are being formulated to provide seafarers

with good basic skills and a wide breadth of understanding concerning maritime matters. Timely retraining is in every sense one of the essential functions to enable seafarers or anyone else, to cope with change when it comes. More than before, the value of refresher courses and upgrading courses should and will be fully appreciated and systematically organised in the formulation of the whole MET system.

On the other hand, it is indeed one rational way to better utilize the apparent over capacity of MET resources, (including facilities, equipment, expertise).

Here, it is the cost of training/retraining that often gives rise to argument, i.e. who will pay. To pay is at all times a visible action while to repay is mostly invisible and unmeasurable. It is most desirable that both trainers and trainees plus employers see that they get Government support in some way, such as direct or indirect investments, grants, study loans, scholarships, tax arrangement or other means. It is a kind of beneficial investment that will repay many times over. Hopefully more governments will be aware of this and do as some are doing now.

- Maritime English

Marine Casualty Investigations show that over 75% of marine casualties are due to human error, among which many are caused by communication problems. No wonder the prime importance of communication - both language and modes, on board ships, between ship and shore or ship and ship - to ship safety is increasingly being recognized and stressed. One recent IMO report has advocated communication being given equal status with navigation.

Since English has already been recognised as the international maritime language, MET in non-English speaking countries has given greater attention to making sure of the necessary professional English language abilities of their seafarers: listening, speaking, reading and writing, on the basis of the English knowledge they have gotten during the general education phase. (Ref. Table 4.2)

Internationally, efforts have been made for years towards standardization of the language used maritime communications, such as IMO Standard Maritime English, Seaspeak and other programs are products of these efforts. During the recent Fourth International Workshop on Maritime English organized by the International Maritime Lecturers' Association (IMLA), a decision was taken and brought back to the respective Governments through all the conference representatives to urge IMO onto a quicker publication of Seaspeak as a recommendatory textbook or workbook for Maritime Oral English. Neither IMO Standard Maritime English nor Seaspeak is considered totally satisfactory even for oral maritime communication, but at least it is an effort towards standardization of basic international maritime communication in order to reduce confusion and contribute to safety.

The worldwide application of VTS systems also increases the need of information being clearly supplied and correctly received. As in most maritime circumstances, there is little

room for error, or for unrestricted language.

Another remarkable international movement to improve overall professional English standard of seafarers is the Anglosea Project. This is a video based maritime English program consisting of 10 modules of about 30 teaching hours each, organized around a video film of 30 minutes duration based on a particular maritime theme. They are: VTS, Salvage Operation, Ship Repair, Safety Onboard, Oil Transport/Pollution, Firefighting, Offshore Supply, Ferry Services, Panama Canal and St. Lawrence Seaway. The first programs will be available for both classroom teaching and onboard self-learning before 1990.

(C)

Equipment

- Simulators

The problem of training-job gap has been recognized for the longest time. Classroom training, even with sophisticated equipment, has always been found to fall short of meeting on the job requirements. This is where the training vessel was introduced to narrow the gap. More importantly and revolutionary, however, is the advent of simulator training, which indeed brings classroom teaching closer to shipboard reality and helps to partly bridge the job-training gap and facilitates the transfer of training to shipboard.

Radar simulators have been gradually developed and in use for a number of years, which offers a considerable degree of complexity in training situations for nautical students, and provide for training in the use of radar, not only as a means for collision avoidance, but also as a tool for navigation.

Early generations of marine simulators restricted training to a limited range of possibilities. Today's developments however offer capabilities which are not always made full use of.

Nowadays, not only many full-mission, ship-handling simulators are becoming popular, but as well many part-task/tailor-made simulators, such as:

- engine room simulators
- communication simulators
- cargo handling simulators
- VTS-training simulators
- dredging simulators,
- etc.

It should be noted also that more are coming into the market every year.

The use of simulators is not only confined to providing training with effective exercises but also with respect to marine casualty investigations, search and rescue(SAR), communication training and other research or research plus training, e.g. "man-machine-environment" relationships, workload studies and other scientific research.

The development of marine simulation offers the use of more advanced technology, while in the operation of a simulator system it is the human element that plays a more important

role. This means that despite the high initial investment cost, failure to make full use of the equipment in teaching, training and research will really make such expensive systems a waste of resources.

Realizing this, efforts have been considerably increased towards making better use of existing simulators by developing exercises which lead to better training results in shorter periods (qualitative and quantitative achievements). The specifications for training programs is approached more systematically from a pedagogic point of view.

Internationally, more than one conference/forum/workshop is held every year (4 in 1987) on all the related subjects from simulator technology itself to detailed exercise development and training procedures. An Internationally Agreed Specification for Radar Navigation Simulators is being formulated.

- Maritime Firefighting and Safety Training Centers

In all the maritime countries, more than one such center has been established to run various short courses regularly aimed at providing all seafarers with the essential basic knowledge and experience of personal survival, first aid, survival craft operation, fire prevention and fire fighting to meet the requirements and standards specified in the IMO/STCW Convention and to improve safety at sea.

The investment in equipment, supporting infrastructures, course development and the actual conducting of the courses is a very expensive business. However, both maritime administrations and MET institutions are totally convinced about the need for them.

It is estimated that the cost of setting up such a full-mission center nowadays will reach 7-8 million US dollars initially. But it is considered a necessary investment to contribute to the safety at sea.

In conclusion it can be said that MET institutions have recognized what is required by a high-tech industry such as modern shipping and that training and education for the same or ahead must include similar technologies.

CHINA AND HER SHIPPING
(TODAY AND TOMORROW)

CHAPTER 5

ECONOMIC AND TRADE DEVELOPMENT

I. CHARACTERISTICS OF THE NATION

China has been in the spotlight since 1980 and earlier, with her rich history, culture, enormous resources, and potential as well as new policies and new possibilities. For many people outside this big country, China is a mystery, a threat, a hope, and a market. China is China. She needs developing and she is developing. Before we go into detail, it is worthwhile to see some of her characteristics (based on personal observations) to facilitate a better understanding.

1. Her huge population and its rapid growth (1.04 billion in 1985 with a growth rate of 1.4% in the last 10 years - RB. 3.2,87), is on the one hand a heavy burden for raising living standards as a whole, while on the other is a great productive force to work, to create and to develop the country.
2. Long tradition, history and rich culture are both an invaluable treasure and in some ways a frustrating burden for the nation. A culture accumulated from more than 5000 years of traceable civilization embodies not only great wisdom and experience but also old habits, traditions, taboos, and restrictions which trammel people's way of thinking and behavior openly or invisibly. This in many cases fetters people's initiative and reduces their acceptance of change and innovation. In a word, it makes the people more conservative and less open-minded by nature.
3. Subconsciously, the nation favours/respects theoretical knowledge more than practical ability; and respects academic activities more than business bustlings. The majority prefer a peaceful and stable well-being status to using all ingenuity to make money. They do have business sense and potential, however.
4. As a huge country, China has to proceed with imbalanced development in all respects - a mix of different stages of development both in terms of material and mentality, attitude and methods. A real picture on the motorways in eastern China suburban areas can be a very useful metaphor. There heavy modern motor vehicles are groaning among slow-moving tractors, bicycles, hand and animal drawn carts and pedestrians. Therefore, it is not a surprise to see people striving for high productivity while employing an old mentality and methods.

People like new things but hate to throw away old ones until

they are absolutely useless. To many of them equipment renewal is more intolerable than low productivity and the latent wastes.

The change of concept of efficiency and effectiveness and the cost-effectiveness concern takes a longer time than one may expect. Aslo, in China, as in most of the old nations, it is impossible not to allow history to colour the future.

5. People seem less motivated as a result of the historical burden and nearly 40 years of public ownership practice, which gives equal treatment to everyone, almost irrespective of his/her ability and productivity. The system secures every one's job for life as well as the slow promotion depending on length of time - the notorious "sharing the food from the Big Pot, each with an unbreakable Iron or Rubber Rice-Bowl". Many are not familiar nor ready for the competition since there has not been such a need previously.
6. Nevertheless, above all this, the Chinese are well-known for their intelligence, endurance and hardwork. Once they are given incentive (in any way) and the opportunity they can make everything, even wonders.

In short, huge material resources, manpower resources and intellectual resources give the nation numerous possibilities and enormous potential to develop despite the historical burdens and present problems. The key question is the willingness and the willpower - from the top to the billion in the fields.

II. PRESENT POLICIES FOR DEVELOPMENT

As a traditional agricultural nation, China has a very short industrial history, which started on a nationwide scale not more than 40 years ago when the People's Republic of China was founded in 1949. In her first 30 years, the Republic had been sort of feeling her way along, which had cost her heavily with a lot of setbacks and some success.

Finally, in late 1970s the nation made up her mind to shift her emphasis to economic development rather than previous more political oriented approach. Economic reform started and was followed up by reforms in all sectors. The system of economic management is changed from the old model of overall central planning to the new one - central planning plus market regulation i.e.- macro-economic controls functioning under the central-planning principles and micro-economic flexibility based on market regulating mechanisms. An open-door trade policy has been employed in place of the self-denial kind of "self-reliance" policy. The law of economy was given due and sincere attention and was all aimed at speeding up the country's development and increasing people's living standard. This is firstly represented in the nation's medium term goal of achieving the "Four Modernizations" in agriculture, industry, science and technology, and the military at the end of this century with a four-fold increase of national GNP from the level of 1980.

The whole nation is mobilized and every activity channeled to

the realization of the goal. So far the result seems promising with the first five years' average annual increase of 10% in GNP and 11% in "total social and industrial and agricultural output value". The volume of import and export totalled 230 billion US dollars, 200% over that of 1975-1980 and China's place in world trade rose considerably.

From now on until 1990, China is in the period of implementing her 7th Five-Year Plan for Economic and Social Development. After constant trying, adapting, adjusting and readjusting in the previous five years, this period is considered to be crucial for the comprehensive reform of the nation's economic structure. It is also important for the material, technological and personnel preparation for the greater economic progress during the 1990s.

The Seventh Five-year Plan for Economic and Social Development (1986 - 1990) has set the major tasks and principles of development for the period as follows: (See RB 4.3)

- "1. To create a favourable economic and social environment and maintain a basic balance between total social demand and supply, so as to facilitate the reform and to lay most of the groundwork for a new type of socialist economic structure with Chinese characteristics within the five years or a little longer.
2. To maintain a steady growth of the economy and, while controlling the scale of investment in fixed assets, vigorously push forward the construction of key projects, the technological transformation of enterprises and the development of intellectual resources, so as to prepare the materials, technology and trained personnel required for continued economic and social development in the 1990s.
3. To further raise the living standards of the people in both town and country on the basis of increased production and better economic performance."

The objectives and tasks of economic structural reform are set as follows:

- "1. To further invigorate enterprises, especially large and medium-sized state enterprises, so that they become relatively independent economic entities, socialist commodity manufacturers and dealers with full authority for their own management and full responsibility for their own profits and losses.
2. To further expand the socialist commodity market and gradually improve the market system; and
3. to shift state control of enterprises from direct to indirect means, in order to establish a socialist macro-economic control system. To regulate economic operations by improving economic and legal means, administrative means being used only as a supplement when necessary."

To fulfil the above tasks and objectives, a restructuring of the planning, pricing, financial, monetary, labour and wage systems are underway in order to develop a whole set of mechanisms which will integrate planning with marketing, micro-economic flexibility with macro-economic control.

During the period, according to the Plan, the total value of industrial and agricultural output will increase by 6.7% and GNP by 7.5% annually on average. The total volume of import and export is set to achieve an average annual growth rate of 7%, reaching US\$ 83 billion by 1990. The export of petroleum, coal, nonferrous metals, grain, cotton, etc. and the proportion of manufactured goods will be increased, while the priority of imports will be given to computer software, advanced technologies and key equipment, as well as to certain essential means of production that are in short supply on the domestic market.

To achieve the set goals, the following guidelines are adopted:

- "-Give priority to reform and make sure that reform and development are adapted to and promote each other.
- Keep a basic balance between total social demand and supply and try to maintain a balance in state finance, credits, materials and foreign exchange and a general balance among these different sectors.
- Give top priority to improving economic results and especially product quality, and maintain a proper relation between economic results and growth rates and between quality and quantity.
- further rationalize the industrial structure so as to keep pace with the people's changing patterns of demand and with the modernization of the national economy.
- Keep total investment in fixed assets within proper limits, rationalize investment patterns and accelerate the development of the energy, transport, telecommunications, and raw and semi-finished materials industries.
- Shift the emphasis of development to the technological transformation, renovation and expansion of existing enterprises, and have them expand reproduction chiefly by intensive means.
- Attach strategic importance to the advance of science and education, promote scientific and technological progress and speed up the development of intellectual resources.
- Open wider to the outside world and link the development of the domestic economy more closely with expanded economic and technological exchange with other countries.
- Further improve the material and cultural lives of both urban and rural residents, on the basis of increased production and better economic results.
- Promote the cultural and ideological advance of socialist society while furthering its material progress.
- In all our efforts to build the country while maintaining our tradition of hard work and thrift.

The important cornerstones of wide-ranging economic reform program were laid in 1985. The readjustment and rejuvenation of the decision-making body at all levels enables younger and better-educated people to the front line to carry out the complex economic reforms.

Everything seems to be oiled and in place for the restructuring of the economy. But difficulties and problems remain evident. "Rome was not built in one day." The reform represents an extensive, profound and sustained transformation and will have an unprecedented impact on long-established models, traditional

concepts, and the forces of habit. Divergences, obstacles, overdoings and setbacks are and will be encountered all along the way - the way to a bright future hopefully.

CHAPTER 6

SHIPPING IN CHINA

I. SHIPPING AND THE NATION'S ECONOMIC DEVELOPMENT

Transportation is the artery of a nation's economy. China's communications and transportation is a weak link in the development of her economy, which hampers a rapid progress and needs urgently improving.

It is a general rule that the development in trade and economy pushes the development of the transport system. In return, the improvement in the efficiency of transport service will give stimulus to trade. Now, more than ever before, the priority is given to the improvement of China's communications and transport system in order to keep abreast with the upsurge of the nation's economy. This is now one of the country's major policies for her economic development. As one mode of the total transport system, shipping, ocean shipping in particular, plays a triple role in China's foreign trade expansion.

1. Provision of Service

Shipping is the cheapest transport means to carry huge volumes of commodities through water routes the world over. In the case of transactions involving bulk primary commodities, ships are almost indispensable due to their large carrying capacity and lower charges.

As always, China is attaching great importance to maximum self-sufficiency in her seaborne trades - the well-known policy of "National cargo in national bottoms". Therefore, an efficient and sufficient shipping service geared to the needs of foreign trade can protect the quality and competitive price of the nation's export goods (which is of vital importance to the success of the sales) and a lowering of the cost of import. All this will ensure a smooth running of trade on an international basis and facilitate the expansion of the scale and volume of the nation's foreign trade. Also, easier accessibility to markets in foreign lands enables domestic markets to flourish, brings prosperity to commerce, and makes increased production possible, resulting in growth of the country's economy.

2. Shipping is itself an important sector of invisible trade.

It is at once a close partner of trade and a channel through which foreign exchange is acquired (or saved) by virtue of its function as carrier. It is very true that both the operations of trade and shipping have an important bearing on the balance of payments of the country regardless of the social system. So successful operations will do much to contribute to the accumulation of foreign exchange, which is vital to the country's economy.

In general, the existence of a national merchant fleet results in:

- limiting of imports of shipping services

- (saving of foreign exchange)
 - export of shipping service (inflow of foreign exchange)
 - shift of capital resources from other sectors to shipping (expenditure)
 - extra imports to satisfy the needs of the shipping industry (ships, their equipment, repairs, etc.)
 - employment opportunities for crews and shoreside personnel, etc.
- (Ref. RB. 4.4. & 4.5)

3. Transition of Advanced Technology

Ships are capital and technology intensive objects which always go in line with international standards. The whole process of establishing, improving and operating a modern and competitive merchant fleet involves tremendous technology developments, advances and transitions. This is in line with the nation's open-door policy which is aimed at upgrading the nation's industry through imports of technology and the encouragement of foreign investment.

II. THE DEVELOPMENT OF THE MERCHANT MARINE

The development of China's merchant fleet is well shown in Table 6.1 (Source: RB 3.1 /86) from 454 ships of 985,486 GRT in 1949 up to 846 ships of 6,336,747 GRT in 1979 and surging to 1,562 of 11,566,974 GRT by 1986 - ranking the 8th in the world fleets (300 GT and above). Among them the ocean-going fleet has undergone a phenomenal growth, rising from an initial 25 ships totalling 229,900 DWT in 1961 to 614 ships of 13,325,000 DWT by 1986 (COSCO Fleet figures only, representing about 90% of the ocean-going fleet and 85% of the nation's total merchant fleet.) (See Table 6.2, 6.3 & 6.4). A further expansion to 23 million DWT has been set as the objective by the end of the century to meet the needs of carrying over 50% of the seaborne trade by then, based on the following careful considerations such as:

- * the nation's fleet does not live in a safe, or in vacuum. It is confronted with the test of competency through sharp competition in the international market. The cargo reservation policy can help secure a maximum of 50% of the available cargo tonnage under the conditions of reliable service quality plus cheaper freight rates.
- * the carrying capacity needed from the nation's fleet is influenced and determined by the following essential factors:
 - concurrent with the trends in world trade (ref. Section II and III of Chapter 1), the ratio between trade volume and the unit value involved is no longer proportional but shows an adverse trend, i.e. along with the economic development of the country, commodity structure, both imports and exports are smaller, lighter in size and weight but higher in value. Since the trade development is calculated in terms of value, it reflects a lower increase in volume needed to be transported, i.e. 2 : 1.5.
 - it is normal practice nowadays that cargoes of large quantity will be shipped under FOB terms. This happens to export of the primary products, which means less possibility of

- employing the nation's fleet.
 - Liner cargo is more and more regulated by 40:40:20 cargo sharing principle laid by the UNCTAD Code of Conduct for Liner Conference and 50:50 through bilateral agreements.
 - an increase in the export sector of the total foreign trade would mean a smaller share of carriage for the nation's fleet.
 - the gradual movement towards self-sufficiency in grain products is stabilizing and will reduce the grain imports by large amounts in the years to come.
 - the rapid development in industry is reducing the import of the medium-technology commodities.
- * The efficiency of shipping reflects the developmental level of a country's total transport system. The improvement of cargo handling and distributing capacity and efficiency of the national ports together with the parallel development of the country's infrastructure - road, rail and inland water-ways will provide shorter port turn-round time - one prerequisite for the improvement of the effective operating rate of the fleet (% of the annual operating days) and sailing rate (% of annual operating days minus port days) of the nation's fleet. The world's best record of fleet operation rate is 98% and sailing rate 70%. It is suggested that if China's ocean shipping fleet can increase its operating rate and sailing rate by 10% and 15%, its carrying capacity will rise by nearly 50% without adding any ships. Right now, apart from the 132 deepwater berths newly built between 1981-1985, another 120 are due to be completed by 1990 including many container terminals, expanding China's annual port handling capacity to about 450mn tons by then. The notorious port congestion is now disappearing from average 40 days before 1986 to present 10 days and less. Quite possibly, the 1990s will not see port congestion in any Chinese port when the inland infrastructure net-work is further improved.
- * Concurrent with the overall expansion of the fleet, fleet renewal and upgrading of its composition is now stressed to enable a more efficient and cost effective performance in the sharp competition throughout shipping world. Table 6. shows the size and age of China's merchant fleet in 1986, about 50% of which is over 15 years old, and 70% over 10 years old. Nearly all of them are to be replaced in the next ten years, finances permitting.

The fleet renewal indicates two facts. Firstly, modern ships of higher technology will result in a better, safer and more efficient operation. Secondly the rationalization of the fleet structure through fleet renewal will add more container and RO/RO vessels to replace the present dominating conventional general cargo vessels, which means a higher carrying capacity and much shorter turnaround time.

- * To improve fleet management is another priority. The improvement in marketing and cargo canvassing ability, in economical and rational fleet operations and in planning and adaptability will ensure better space utilization and fleet employment on the one hand and facilitate a further penetration into the cross trades on the other.

All this is to say that to keep pace with the growth of trade does not mean to keep the proportional expansion of the fleet. Efficiency and sufficiency are the two key objectives to be achieved and sufficiency should be firmly based on efficiency.

Table 6.1

MERCHANT FLEETS: 1921-1986 (continued)

YEAR	CANADA		CHINA, PEOPLE'S REPUBLIC OF		TAIWAN, PROVINCE OF		CYPRUS		DENM
	Steam & Motor		Steam & Motor		Steam & Motor		Steam & Motor		Steam &
	No.	Gross Tonnage	No.	Gross Tonnage	No.	Gross Tonnage	No.	Gross Tonnage	No.
1921	613	999,031							
1922	629	1,064,388							587
1923	633	1,082,067							622
									614
1924	651	1,080,215							622
1925	660	1,096,753							652
1926	664	1,132,723							661
1927	669	1,151,494							469
1928	693	1,188,111							627
1929	726	1,239,769							623
1930	744	1,234,713							643
1931	795	1,344,374							677
1932	805	1,374,189							702
1933	805	1,331,024							705
1934	797	1,315,808							686
1935	782	1,294,791							694
1936	798	1,291,351							695
1937	797	1,257,463							691
1938	787	1,211,627							694
1939	782	1,223,961							705
*									
1948	984	2,006,689							667
1949	1,178	2,097,182	454	985,485			21	16,328	698
1950	1,158	1,931,473	405	816,085			18	14,891	718
1951	1,126	1,647,434	336	633,228			12	11,734	715
1952	1,151	1,692,045	322	613,821			10	9,182	695
1953	1,148	1,651,914	322	659,006			10	10,036	701
1954	1,122	1,610,342	324	660,428	not recorded separately		9	4,797	704
1955	1,095	1,521,015	283	567,283			9	6,005	680
1956	1,081	1,503,573	270	552,552			8	5,191	687
1957	1,105	1,521,241	261	541,690			3	1,450	715
1958	1,096	1,515,887	257	539,830			5	1,846	751
1959	1,079	1,501,025	262	623,435			2	905	787
1960	1,085	1,578,077	201	402,417	68	281,662	2	991	808
1961	1,080	1,668,955	212	472,677	87	372,898	1	138	827
1962	1,063	1,703,549	219	522,481	102	485,601	1	138	873
1963	1,087	1,796,440	215	502,038	106	520,049	1	138	879
1964	1,132	1,823,387	216	535,427	117	588,355	4	17,435	901
1965	1,154	1,829,741	213	551,143	128	638,274	9	46,454	923
1966	1,188	2,125,424	231	669,299	166	770,028	35	181,806	1,005
1967	1,236	2,305,502	247	772,125	174	775,397	60	360,815	1,072
1968	1,296	2,402,983	239	765,545	187	762,515	109	652,588	1,140
1969	1,278	2,450,944	237	791,893	216	961,807	134	770,463	1,194
1970	1,266	2,399,949	248	867,994	274	1,166,230	207	1,138,229	1,210
1971	1,228	2,366,175	265	1,022,266	316	1,321,768	277	1,498,114	1,264
1972	1,235	2,380,635	286	1,181,179	399	1,494,903	394	2,014,675	1,331
1973	1,235	2,422,802	323	1,478,992	413	1,467,311	589	2,935,775	1,362
1974	1,231	2,459,998	360	1,870,567	407	1,416,833	722	3,394,880	1,349
1975	1,257	2,565,501	466	2,828,290	428	1,449,957	735	3,221,070	1,371
1976	1,269	2,638,692	551	3,588,726	438	1,483,981	765	3,114,263	1,413
1977	1,283	2,822,948	622	4,245,446	443	1,558,713	800	2,787,908	1,407
1978	1,289	2,954,499	713	5,168,898	444	1,619,595	793	2,599,529	1,397
1979	1,290	3,015,752	846	6,336,747	490	2,011,311	762	2,355,543	1,315
1980	1,324	3,180,126	955	6,837,608	497	2,039,123	688	2,091,089	1,253
1981	1,300	3,158,864	1,051	7,653,195	498	1,887,836	588	1,818,997	1,169
1982	1,299	3,212,562	1,108	8,056,849	511	2,225,377	557	2,149,869	1,152
1983	1,300	3,384,677	1,179	8,674,599	514	2,879,200	593	3,450,241	1,112
1984	1,310	3,449,496	1,262	9,300,358	543	3,958,418	737	6,727,887	1,101
1985	1,286	3,343,823	1,408	10,568,236	583	4,327,487	844	8,196,056	1,070
1986	1,249	3,160,043	1,562	11,566,974	587	4,272,795	940	10,816,809	1,063

*Owing to war, statistics were not compiled for the years 1940 to 1947.

Table 6.2

歷年船舶數量統計

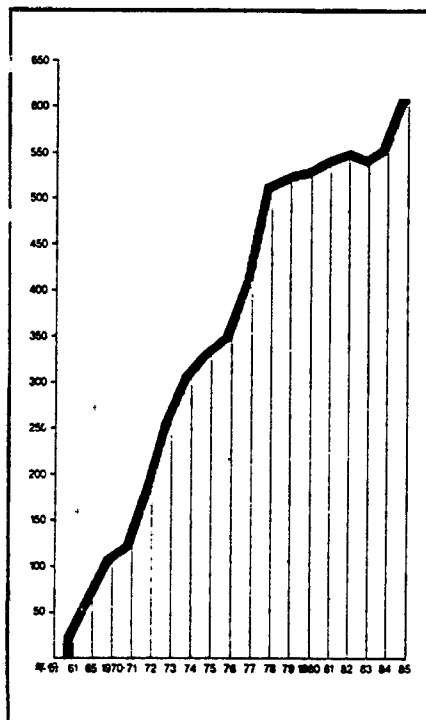
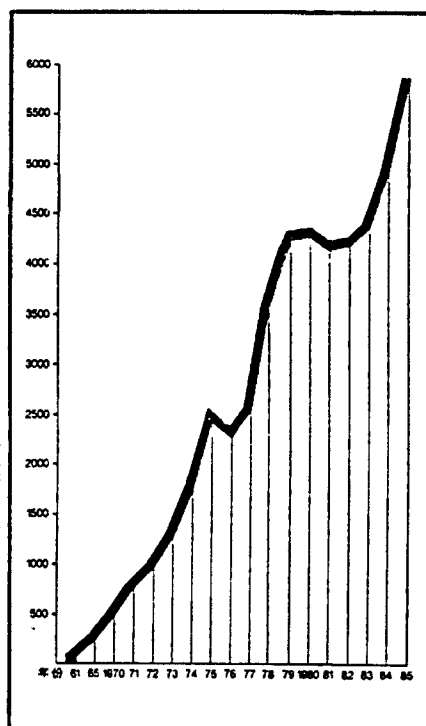
Growth of Fleet
(1961 - 1985)

Table 6.3

歷年貨運量統計

Growth of Freight
Volumes (1961-1985)

Year	Vessels	DWT (1,000 tons)
1961	25	229.9
1962	31	270
1963	36	331.3
1964	56	517.6
1965	63	601.8
1966	71	706.5
1967	86	869.1
1968	89	903.6
1969	102	1,058.9
1970	107	1,122.8
1971	122	1,298.2
1972	184	2,141
1973	256	3,223.3
1974	304	4,499.7
1975	330	5,380.5
1976	347	5,654.2
1977	405	6,546.1
1978	510	8,573.5
1979	521	9,058.3
1980	527	9,631
1981	536	9,848.3
1982	547	10,050.8
1983	540	10,094.9
1984	551	10,459
1985	614	13,325.5

Year	Volumes (10,000 tons)
1961	85
1962	79
1963	88
1964	151
1965	246
1966	272
1967	238
1968	264
1969	345
1970	499
1971	783
1972	972
1973	1,270
1974	1,740.6
1975	2,424.8
1976	2,382.3
1977	2,553.2
1978	3,659.7
1979	4,249.5
1980	4,280.9
1981	4,153.3
1982	4,185
1983	4,273.8
1984	4,938.2
1985	5,895.4

Table 6.4

SIZE AND AGE OF ALL STEAMSHIPS AND MOTORSHIPS (continued)

DIVISIONS OF TONNAGE	DIVISIONS OF AGE												TOTAL			
	0-4 YEARS		5-9 YEARS		10-14 YEARS		15-19 YEARS		20-24 YEARS		25-29 YEARS		30 YEARS & OVER		No.	Gross Tonnage
	No.	Gross Tonnage	No.	Gross Tonnage	No.	Gross Tonnage	No.	Gross Tonnage	No.	Gross Tonnage	No.	Gross Tonnage	No.	Gross Tonnage	No.	Gross Tonnage
CHINA, PEOPLE'S REPUBLIC OF																
100 - 499	28	8,170	51	12,074	59	18,147	45	14,114	15	4,821	10	3,505	24	7,621	232	68,452
500 - 999	6	4,355	17	12,832	30	25,091	18	15,336	4	2,771	1	889	38	27,458	114	88,732
1,000 - 1,599	5	5,953	20	25,993	10	15,339	7	8,931	1	1,313	2	2,696	12	15,046	57	75,271
1,600 - 1,999	...	...	3	5,444	31	55,687	11	21,199	3	5,350	2	3,905	7	13,008	57	104,593
2,000 - 3,999	31	100,845	46	142,856	33	107,239	33	102,377	18	53,891	25	78,436	30	91,343	216	676,987
4,000 - 5,999	27	128,092	16	88,291	31	150,398	20	101,281	15	76,028	23	112,795	14	71,159	146	728,044
6,000 - 6,999	14	90,863	3	20,397	9	59,005	7	45,330	11	69,918	11	69,904	7	45,340	62	400,757
7,000 - 7,999	1	7,961	3	22,868	7	51,624	14	105,070	3	22,194	7	53,091	14	102,517	49	385,325
8,000 - 9,999	16	148,777	41	385,049	54	526,662	39	366,659	34	311,719	53	476,908	11	97,389	248	2,313,163
10,000 - 14,999	24	304,864	38	442,446	32	352,901	30	333,186	25	286,279	24	277,432	7	80,017	180	2,077,125
15,000 - 19,999	12	225,765	23	389,993	30	504,679	14	235,528	19	317,105	3	51,142	...	...	101	1,724,212
20,000 - 29,999	27	670,869	4	110,538	8	175,226	13	294,386	16	375,643	...	...	1	20,818	69	1,647,480
30,000 - 39,999	9	336,063	...	...	6	210,696	1	30,724	5	173,052	...	...	...	...	21	750,535
40,000 - 49,999	...	...	...	...	...	...	4	169,099	2	82,120	...	...	...	...	6	251,219
50,000 - 59,999	...	...	...	...	1	50,342	1	55,482	...	...	...	...	...	...	2	105,824
60,000 - 69,999	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
70,000 - 79,999	...	...	...	...	1	79,274	...	...	...	...	...	...	...	...	1	79,274
80,000 - 89,999	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
90,000 - 99,999	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
100,000 - 109,999	...	...	...	...	1	109,981	...	...	...	...	...	...	...	...	1	109,981
110,000 - 119,999	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
120,000 - 129,999	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
130,000 - 139,999	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
140,000 and above	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
TOTAL	200	2,032,577	265	1,658,781	343	2,492,291	257	1,898,702	171	1,782,204	161	1,130,703	165	571,716	1,562	11,566,974
TAIWAN, PROVINCE OF																
100 - 499	23	7,926	42	11,132	96	29,564	151	36,168	21	7,260	6	2,608	11	3,992	350	98,648
500 - 999	2	1,359	5	3,246	10	8,419	7	5,067	6	4,529	1	798	4	2,830	35	26,248
1,000 - 1,599	3	4,200	...	...	1	1,411	2	3,169	3	3,846	...	...	1	1,459	10	14,085
1,600 - 1,999	...	...	...	...	2	3,541	7	13,504	6	11,268	1	1,766	...	...	16	30,079
2,000 - 3,999	1	3,921	9	35,340	8	23,632	18	55,999	2	5,633	...	...	2	4,821	40	129,346
4,000 - 5,999	...	...	6	30,178	5	23,956	5	23,906	...	...	...	...	...	...	16	78,040
6,000 - 6,999	...	...	1	6,230	2	12,844	1	6,271	...	...	...	...	...	...	4	25,345
7,000 - 7,999	...	...	1	7,097	...	...	...	...	...	...	...	...	...	...	1	7,097
8,000 - 9,999	...	...	3	26,350	...	...	...	...	...	...	...	...	...	...	3	26,350
10,000 - 14,999	2	29,206	5	67,240	4	49,153	6	68,900	...	...	...	...	...	...	17	214,499
15,000 - 19,999	3	55,192	9	160,781	2	35,179	4	69,817	...	...	...	...	...	...	18	320,969
20,000 - 29,999	6	144,196	5	126,443	...	...	1	28,060	...	...	...	...	...	...	12	298,699
30,000 - 39,999	23	820,073	12	394,792	4	143,237	5	171,433	...	...	...	...	...	...	44	1,529,535
40,000 - 49,999	...	...	...	...	1	40,567	...	...	...	...	...	...	...	...	1	40,567
50,000 - 59,999	...	...	1	50,710	3	154,344	3	159,324	...	...	...	...	...	...	7	364,378
60,000 - 69,999	...	...	...	...	3	193,379	...	...	...	...	...	...	...	...	3	193,379
70,000 - 79,999	2	149,486	...	...	...	...	1	78,021	...	...	...	...	...	...	3	227,507
80,000 - 89,999	2	160,560	...	...	3	262,813	...	...	...	...	...	...	...	...	5	423,373
90,000 - 99,999	...	...	...	...	1	93,355	...	...	...	...	...	...	...	...	1	93,355
100,000 - 109,999	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
110,000 - 119,999	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
120,000 - 129,999	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
130,000 - 139,999	...	...	1	131,296	...	...	...	...	...	...	...	...	...	...	1	131,296
140,000 and above	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
TOTAL	67	1,376,119	100	1,050,835	141	788,660	215	1,006,373	38	32,536	8	5,170	18	13,102	587	4,272,795

III. MANNING POLICY AND THE DEMAND FOR TRAINING AND EDUCATION

1. Three Basic Facts

A. Employment System in China

As mentioned in Section I, Chapter 5, the "life-long employment system" has been practised for nearly 40 years and applies to all the employees of any state-owned enterprise. For a national fleet, this means very high stability of the crews with very little wastage. It is good from the view point of manpower planning and fleet manning, but very limiting for manpower optimization. The sense of commitment and sense of responsibility of the crews can be strong when they are well motivated but can be low due to the "iron rice bowl" mentality.

The contracting system has recently been introduced, but it takes time to get used to it for both employers and employees.

B. Wage Policy

Due to the fact of population and the nature of the social system, China has adopted the policy of "low wage, low price and more employment". This is a big advantage for the national fleet operating on an international basis, especially when others are struggling with high manning costs.

C. Structural Shortage of Seafarers

The rapid expansion of the merchant fleet in the last ten years, coupled with the inefficiency and insufficiency of training and education during the period of the eleven-year long Cultural Revolution (1966 - 1976) resulted in a temporary shortage of skilled seamen, especially well-educated, trained and updated senior officers. Now the shortage is disappearing when more and more maritime school graduates are joining the fleet. But the potential problem of smooth replacement of the previously over-promoted officers is now coming to the surface.

2. Manning Policies

In the course of striving to enhance the productivity and competitiveness of the fleet, it is becoming evident that neither productivity nor safety will be obtained by means of technology alone; the quality of the management and fleet personnel play an equally important role.

a) Manning System

Shipboard management systems have been practised on board Chinese ships for years with limited authorities. The newly introduced "economic responsibility system on a single-vessel basis" and planned maintenance system give more responsibility and authority to the shipboard management team. Accountability for the use of resources and for goal achievement is added to the previous standards.

To achieve all this, a double-crewing system (i.e. crew rotation is done among the double numbered crew members fixed to a certain ship for 2 - 3 years) is to be gradually implemented in

order to have continuity of senior officers on board and a more committed role for ratings.

In spite of the fact that the fleet does enjoy the advantage of low manning costs, the optimum manning is placed as prerequisite to the double manning system. The optimum manning scale is applied based on the case to case assessment of each individual ship - her type, age, technology, maintenance requirement and her trading engagement with the aim of minimizing the overall costs. (Refer to the optimum point in Fig. 2.4, Chapter 2 - the cost-effectiveness concept.)

B. New Certification Scheme

The competition among enterprises is actually a competition of their personnel. It is their quality that decides the rise or fall of the enterprises. Therefore, the investment on training is of paramount importance as is technology and equipment. Fully aware of this, a new certification scheme was introduced and is to be fully in force in 1990 aimed at quality enhancement and control.

According to the new scheme, every ship's officer is obliged to obtain the following seven certificates in addition to his Certificate of Competency:

- Firefighting and Fire Prevention
- Personal Survival at Sea
- First Aid
- Life Craft/Boat Operating
- Radar Operation
- ARPA Operation
- VHF Communication;

Ratings must obtain their respective Post Technical Certificates (through training/upgrading courses) in respect to the requirement for the posts they are to hold.

C. Registration of Seamen

The introduction of the computer network system enables the personnel authority to do a thorough and detailed reassessment of all the seafarers and establish a more comprehensive seamen's registration system.

**

All of the above new measures in addition to the traditional ones are exclusively aimed at enhancing and guaranteeing the competency of the Chinese seafarers, which generates a higher and constant need for the nation's MET, especially short-term training courses and upgrading/updating courses. The double-crewing system offers the availability of the seafarers to be trained, either according to need or according to the schedules.

This system, therefore, provides good future prospects and incentives to seafarers with respect to promotion and career development.

PART III
MARITIME
EDUCATION AND TRAINING
IN CHINA

CHAPTER 7

POPULATION AND EDUCATION

1. POPULATION AND EMPLOYMENT

It is true that the world never talks about China without thinking of or mentioning her big population - 1/4 of the world's total. It is on them and their quality that the country's destiny and development are dependent. If we say that to feed one billion people is one of the most difficult achievements in this world yet, it is a far more challenging task to have them properly educated, trained and duly employed.

1. The Growth of Labour-Age Population

According to the population and labour force forecasts done according to census data (1982), China will have a 200,000,000 net increase of labour age population (Male: 16-59, Female: 16-54) from 1982 to 1998 with average annual increase of 13,750,000 at a rate of 1.94%. (See Table 7.1, Source: Population Studies 2/1986)

2. Quantitative Demand for Employment and Higher/Vocational Education

Consequently, in the next ten years the country will face the peak period demand for higher/vocational education and employment i.e. nearly 13,000,000 every year after the 9-year compulsory general education.

3. The Problem of Structural Unemployment

Due to the rapid growth of population and the resultant incompatible education and training capacity, China has always suffered the shortage of well educated personnel at all levels. The problem of structural unemployment is becoming conspicuous, i.e. the basic labour market is over saturated while there are many vacancies in medium to higher technological fields and a shortage of expertise in all leading posts. This creates a tremendous need for education and training to enhance people's knowledge level and to further the possibility of upward mobility.

4. A New Consideration Added to the Employment Policies

Being a developing socialist country, an other major factor must be considered, that being the shortage of foreign exchange. It is and will remain a prominent economic consideration for a some time to come. To promote broader and deeper economic, trade and technological exchanges with other countries, with emphasis on enhancing the capacity to earn foreign exchange through exports is one of the basic goals and a major principle of development

Table 7.1

Labour Age Population Forecasts (,000)

Year	CHINESE STANDARD		Total
	M(16-59)	F(16-54)	
1982	297,162	260,073	557,235
1983	304,717	267,211	571,928
1984	313,262	274,836	588,098
1985	323,334	284,336	607,670
1986	332,386	292,701	625,087
1987	341,938	301,614	643,552
1988	350,303	309,285	659,588
1989	358,193	316,553	674,749
1990	365,607	323,261	688,868
1991	371,529	328,903	700,432
1992	376,863	333,756	710,619
1993	381,552	338,175	719,697
1994	385,392	342,248	727,640
1995	389,753	346,822	736,575
1996	393,538	350,704	744,242
1997	396,664	353,849	750,513
1998	401,480	358,525	760,006

Year	INTERNATIONAL STANDARD		Total
	M(16-64)	F(15-64)	
1982	319,452	297,813	617,265
1983	328,403	306,412	634,815
1984	339,127	316,766	655,938
1985	348,709	325,967	674,676
1986	358,658	335,530	694,188
1987	367,336	343,909	711,245
1988	375,982	352,305	728,287
1989	383,743	359,874	743,617
1990	390,222	366,256	756,478
1991	396,041	372,056	768,097
1992	401,253	377,313	778,566
1993	405,686	381,855	787,541
1994	410,690	386,886	797,576
1995	414,706	390,986	805,692
1996	418,754	394,761	813,115
1997	423,538	399,926	823,464
1998	-	-	-

in the short and medium term. To contract for more construction projects and labour services abroad is for the first time being highlighted as one of the promoting objects. For a country like China, this would meet three needs at one time, namely:

- increasing the capacity to earn foreign exchange
- increasing the employment possibility, and
- promoting technical and cultural exchange.

II. EDUCATION

In the course of striving for modernization it is now, more than ever, realized that the advance of science and technology is the profound source of the vitality of China's future economic development. Especially under the present circumstances when more and more countries are shifting their attention to the development of science and technology following the new worldwide technological revolution. Lacking proper policies and/or the nation's understanding of the strategic importance of science and technology will result in widening rather than narrowing the gap between China and the developed countries.

It goes without saying that scientific and technological progress and the success of the modernization drive will depend very much on the advancement of education and the training of competent personnel. Therefore it is China's consistent long-term strategy to attach greater importance to education. In the implementation of the present Seventh Five-year Plan, the total outlay for education will amount to 116.6 billion yuan (equivalent to 31.5 billion US dollars), 72% higher than that of the last five years. This will represent a growth rate higher than that of state revenues from regular items. In addition, local governments at all levels are asked to allocate more funds for the development of education and additionally state enterprises, collectives and other sectors of the society are all encouraged to sponsor different types of educational programs.

Apart from general education, new attention is being given to improving vocational and technical training as well as higher education and adult education. Special emphasis is laid on quality while rationalizing the educational structure to meet the needs of modernization. The steady increase of enrollments in accordance with actual conditions is a second priority.

A nationwide reform of the educational structure has been under way since 1985 with the fundamental aim of improving the quality of the nation and producing as many skilled personnel as possible. Administratively the educational institutions are delegated more authority and given more decision-making power and flexibilities as long as they are in line with the state's unified policies and plans. At the same time, the reform of the labour and personnel system and job-assignment system are following up. Through these reforms China intends to usher in a new educational milieu in which:

- elementary education will be substantially strengthened,
- vocational and technical education will be greatly expanded,
- colleges and universities will be able to exploit their potential and exercise their initiative to the fullest,
- outside-school and after-school education as well as regular school education will develop simultaneously, and education of

all kinds and at all levels will actively address the multiple needs of economic and social development.

Vocational and Technical Education

Vocational and technical education has always been the weakest link in the whole chain of China's educational system because of the deeply-rooted, out-worn concept of belittling this kind of education and inadequate employment policies. Now the country is more and more realizing the fact that her modernization not only requires senior scientific and technical experts but also urgently requires millions of intermediate and junior engineers, managerial personnel and technicians with adequate vocational and technical education background as well urban and rural workers who are well trained vocationally. Without them, advanced sciences and technologies and sophisticated equipment cannot be translated into productive forces.

Now, great efforts are being made to expand the number of vocational and technical schools. Young people, beginning at the junior high school level, are generally divided into two groups, with one group of graduates entering regular senior high schools and the other receiving senior middle vocational and technical education; one group of senior high school graduates entering regular colleges and universities and the other receiving senior vocational and technical education.

Geared to the needs of economic and social development, academic stress is laid on the enhancement of professional skills. These cover a wide area and are coupled with the appropriate proportion of general education so as to provide long-term and wide options for jobs and meet the requirements of technical innovations and advanced studies. Education in professional ethics and discipline is also given due attention.

Complementary measures to reform the relevant rules and regulations of the employment system are being carried out to put into effect the principle of "training before employment". From now on no one, particularly those to be engaged in highly specialized and technical work, is allowed to take up the job unless he has received his qualification certificate.

At the same time, efforts are being made to develop advanced vocational and technical institutions which will first enrol those who have graduated from secondary vocational or technical schools with the required specialized training as well as those employees who are experienced in their special lines and have passed the entrance examinations. All these endeavours are aimed at gradually establishing an effective system of vocational and technical education with a rational structure, ranging from elementary to advanced levels, embracing all trades and linking up with regular education.

In 1990, student enrollment in all types of full-time secondary vocational and technical schools is expected to be 3.6 million, 65% over 1985 and equal to that of regular high schools.

Regular Higher Education

Institutions of higher education are charged with the important tasks of training advanced specialized personnel and of developing science, technology and culture. China's strategic

goal in the development of higher education is:

"By the end of the century, China will have built a well-proportioned, rationally-tiered system embracing a complete range of disciplines and areas, on a comprehensive scale conforming to its economic strength..."(RB 4.6)

To attain the goal, the following restructuring measures and principles are introduced:

- more authorities and decision-making power are given to the institutions to enable more flexibility and adaptability in education
- enrollment planning and job assignment for graduates are to be reformed. Unified enrollment of all students according to state plans and guaranteed job assignment for all graduates by the state are to be replaced by the following three joint methods:
 - 1) Enrollment according to state plans.
 - 2) Enrollment by commission from industries, enterprises and other units that need graduates. Schools are encouraged to make the best use of their resources, enrol more students and meet the demand for skilled personnel. Training fees and graduates' assignments will be in accordance with the contracts.
 - 3) Enrollment of a small number of self-supporting students outside the state plan. These students will pay tuition for their training. After graduation, they may find jobs by themselves or through schools' recommendations. Students in all three categories must pass state examinations before they may be enrolled.
- readjustment and restructuring are carried out to serve the needs of economic and social development and scientific and technological progress; to rationalize the distribution of disciplines and step up the growth of such weak departments and specialities as finance and economics, political science, law and management, etc.; and to foster new-rising/futuristic and frontier disciplines.
- closer co-operation and consolidation of education, research and industry is further stressed and encouraged
- postgraduate studies are to be further improved and emphasized in order to strengthen scientific research and produce competent specialists, etc.

It is expected that in 1990, 750,000 students will enter regular or special undergraduate programmes offered by various types of full-time institutions of higher education, 25% over the 1985 figure, while 55,000 will be admitted to postgraduate programmes, 17% more than 1985.

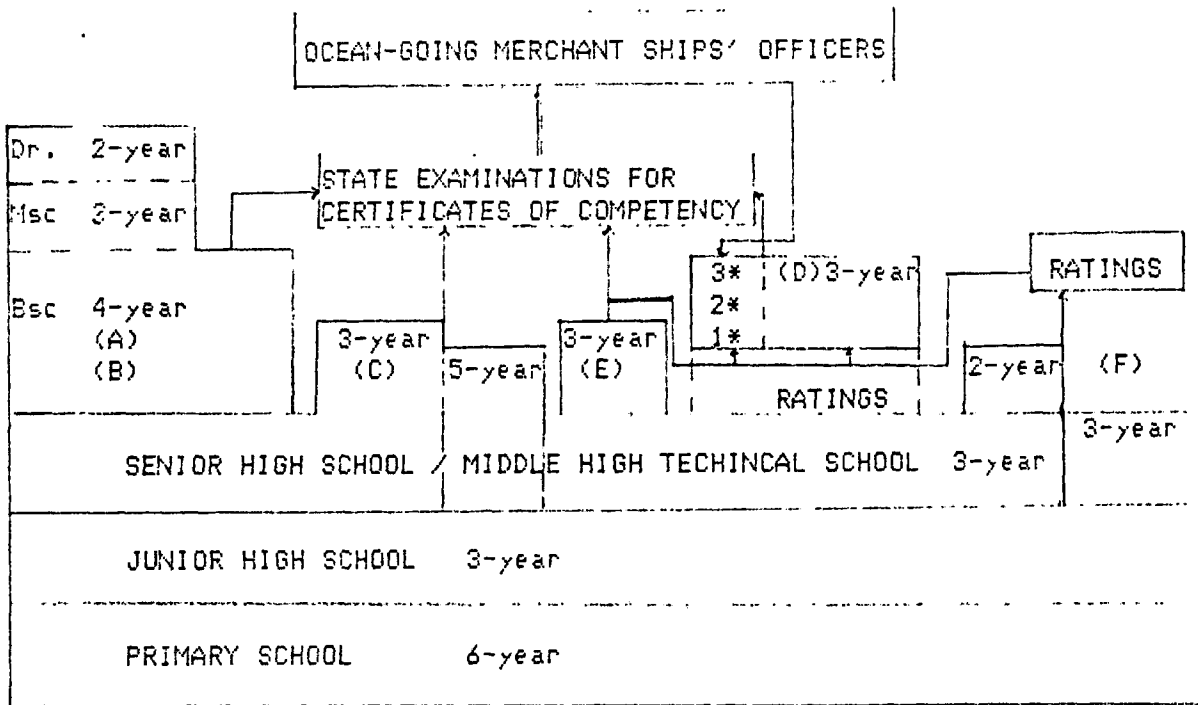
Adult Education

Greater attention is being given to adult education recently. In all forms of adult higher education, stress is laid on combining theoretical study with practice and on working for actual results and better quality.

On the average over 400,000 adults obtain their qualifications at or above the level of college graduate every year.

Fig. 8.1

MARITIME EDUCATION AND TRAINING SYSTEM EDUCATION IN CHINA (PRESENT)



- A - DALIAN MARITIME UNIVERSITY
- B - SHANGHAI MARIME COLLEGE
- C - JIMEI NAVIGATION INSTITUTE
- D - QINGDAO OCEAN-SHIPPING MARINER COLLEGE
- E - DALIAN MARINE SCHOOL
- F - SEAMEN SCHOOLS

Fig. 8.2 GEOGRAPHICAL LOCATIONS OF THE MET INSTITUTIONS

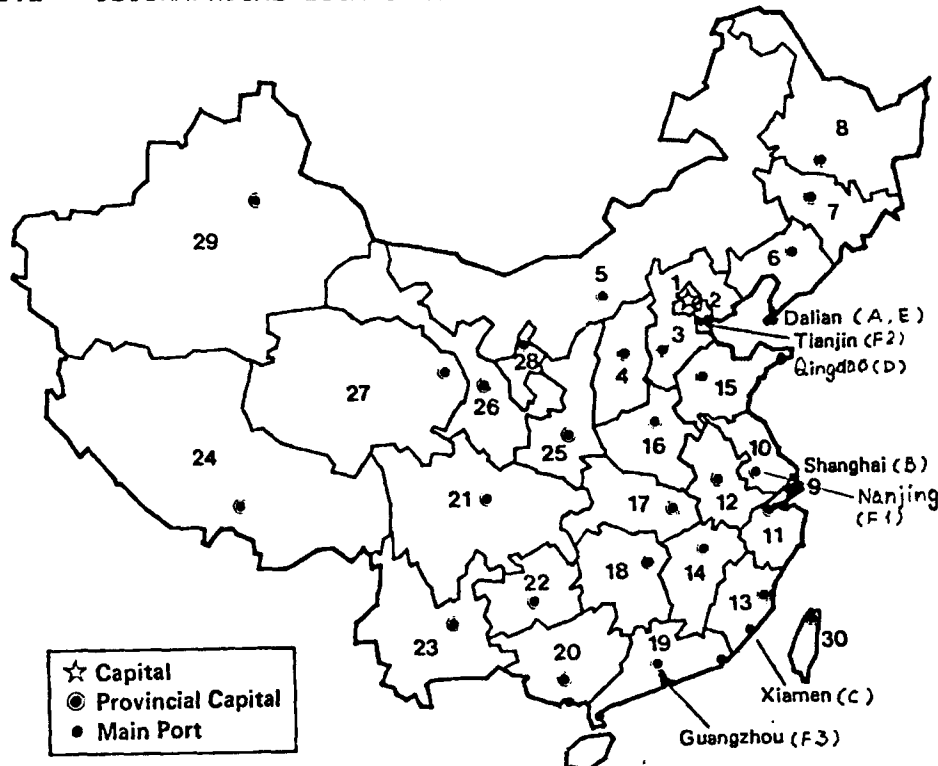
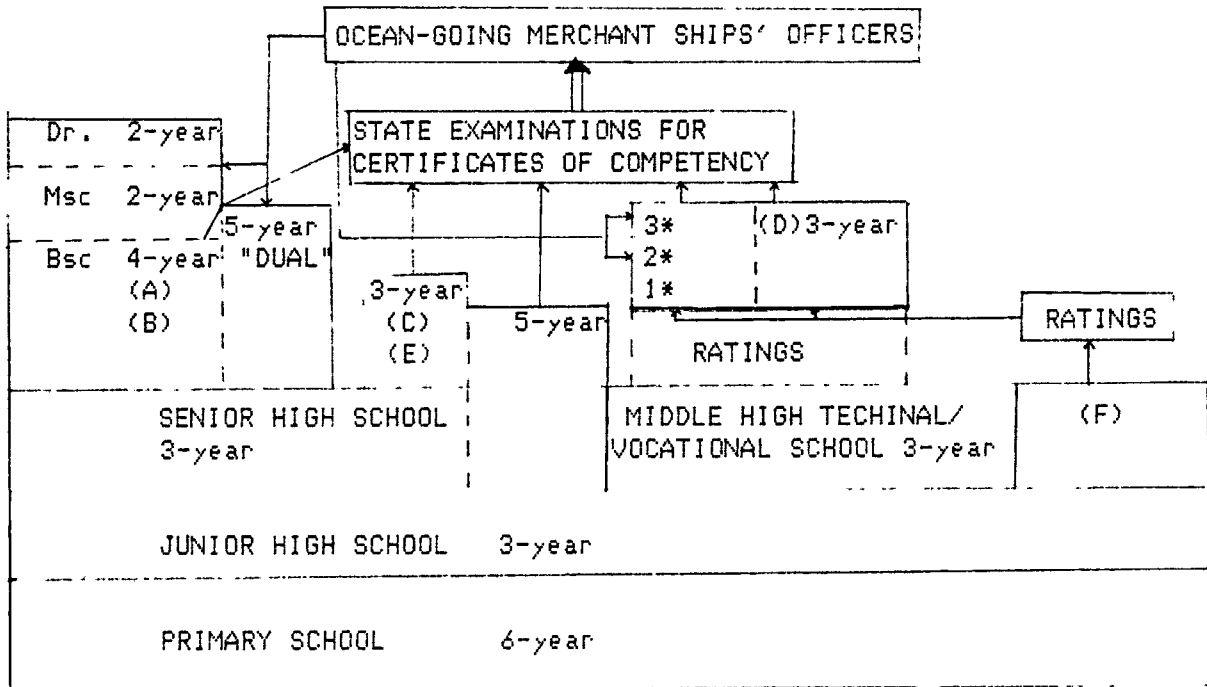


Fig. 9.1

MARITIME EDUCATION AND TRAINING SYSTEM EDUCATION IN CHINA (FUTURE)



- A - DALIAN MARITIME UNIVERSITY
- B - SHANGHAI MARIME COLLEGE
- C - JIMEI NAVIGATION INSTITUTE
- D - QINGDAO OCEAN-SHIPPING MARINER COLLEGE
- E - DALIAN MARITIME COLLEGE
- F - SEAMEN SCHOOLS
- * - SHORT COURSES

CHAPTER 8

PRESENT MARITIME EDUCATION AND TRAINING SYSTEM

I. EXISTING SYSTEM

As one discipline of the whole national education system, China's MET institutions are carrying out the education and training of seafarers and related shore personnel for the country's internal needs. At present there are five middle and higher educational institutions engaged in fostering oceangoing merchant marine officers while three are engaged in bringing up sea-going ratings. (Ref. Fig. 8.1 & 8.2)

A. DALIAN MARITIME UNIVERSITY (1953)

1) Location:

Dalian City, Northeast seaport of China

2) Features:

- a comprehensive marine institution of higher learning
- one of the 80 key national institution of higher learning fixed by the Government
- the Asian-Pacific Region Maritime Training Center
- the World Maritime University Dalian Branch

3) Specialities:

- maritime transport (Stress)
- engineering
- management

4) Departments and Course Specialities:

() = average yearly enrollment

- Navigation (160)
 - Ocean-going Ships Navigation
 - Ships Radio Communication and Radio Navigation
- Marine Engineering (245)
 - Marine Engineering Management
 - Ships Electrical Engineering Management
- Electronic Engineering (85)
 - Electronic Engineering
 - Communication Engineering
 - Electronic Techniques (Special Course)
- Computer Science and Automatic Control (85)
 - Computer and Its Application
 - Automatic Control
 - Managerial Information System
- Maritime Law and Shipping Administration
 - Shipping Management Engineering
 - port management
 - shipping economics
 - Maritime Law
 - maritime law
 - basic law
 - Maritime Safety Administration
- Social Science
 - Ship's Political Work (Special Course)
 - Scientific Education Management (Special Course)
- Technical Foreign Language
- Basic Science
- Physical Education
- First-year Students in Maritime Specialities

- Adult Education (300)
 - Sparetime College
 - Correspondence College
 - Navigation Science and Technology Research Center
 - Ship Metals Technology Research Center
- 5) Academic Degrees Awarded
- Bachelor Degrees by all the 12 specialities
 - Master Degrees by 8 specialities through postgraduate courses
 - Doctorates by 3 specialities through doctorate postgraduate courses
 - * For graduates of seafaring specialities, after passing the examinations for Certificate of Competency co-conducted by the College and Harbour Superintendent Authority on behalf of the Ministry of Communications):
 - 2nd Mate Certificate for navigation graduates
 - 2nd Engineer Certificate for Marine Engineering graduates
 - Radio Officer Certificate for Ship Radio Communication and Radio Navigation graduates
 - etc.
- 6) Enrollment and Study Duration:
- Undergraduates
 - (4-year full-time courses):
 - Senior High school graduates who have passed the annual state college entrance examinations
 - Postgraduates for Master Degree
 - (3-year full-time courses):
 - Bachelor Degree holders or the equivalents who have passed the annual state examinations for Master Degree Studies
 - Doctorate students:
 - Master Degree holders or the equivalents who have passed the annual state examinations for Doctorate studies
 - Students for special courses specified otherwise accordingly
- 7) Total Students Enrollment: (by 1986)
- undergraduates: around 3000 (3500 in 1990)
 - postgraduates: over 200
 - (Adult education and special courses or short courses excluded)
- 8) Teaching Faculty: (by 1986)
- teachers, lecturers and engineers (around 700)
 - among them nearly 100 are professors and associated professors
- 9) Teaching Equipments and Installations:
- 57 laboratories and centers
 - 3 training vessels
 - 1 factory attached to the College
- B. SHANHAI MARITIME COLLEGE (1959)
- 1) Location:
- Shanghai City, Mid-east seaport of China
- 2) Features:

- a comprehensive maritime institution
- 3) Specialities:
 - shipping managerial sciences
- 4) Departments and Course Specialities:
 - Water Transport Economics
 - Shipping Managerial Engineering
 - Shipping Economics
 - Shipping Finance and Accounting
 - Ocean Shipping
 - Maritime Law (Master Degree Course)
 - Ocean Shipping Business
 - English Language
 - Navigation
 - Maritime Navigation Technology
 - Marine Engineering
 - Maritime Engineering
 - Electronics and Automation
 - Ship Electrification and Automation
 - Computer Technology and Its Application
 - Port Machinery
 - Design and Manufacturing of Port Machinery
 - Basic Science
 - Shipping Economics Research Center
 - Marine Law Consultancy
- 5) Academic Degrees Awarded
 - Bachelor Degree (See A.5)
 - Master Degree (See A.5)
 - * Seafaring Certificate (See A.5)
- 6) Enrollment and Study Duration: (See A.6)
- 7) Total Students Enrolment: (by 1986)
 - Undergraduates: about 3000
(5000 in 2000)
 - Postgraduates: over 100
 - (Special courses, upgrading courses and short courses excluded)
- 8) Teaching Faculty
 - nearly 600
- 9) Teaching Equipment and Installations:
 - over 40 laboratories and centers
 - 2 training vessels
 - 1 training factory

C. JIMEI NAVIGATION INSTITUTE (1920)

- 1) Location:
 - Xiamen City, China's southeast island seaport
- 2) Features and Specialities
 - a specialized institution of higher learning
 - specialized in navigation and marine engineering technology
- 3) Departments and Course Specialities:
 - Navigation:

- Seagoing Navigation Technology
 - a) 3-year program for senior high school graduates (150)
 - b) 5-year program for junior high school graduates (30) (new)
 - c) 1-year upgrading program for future chief mates and captains (30) (new)
 - Chief Steward (30)
 - Marine Engineering
 - Marine Engineering
 - a) 3-year program for senior high school graduates (150)
 - b) 5-year program for junior high school graduates (30) (new)
 - c) 1-year upgrading program for future first engineers and chief engineers (30) (new)
 - Ship electrics and electronics (60)
 - Sparetime College (3-year program)
 - Correspondence College (3.5-year program)
 - Basic Science
- 4) Academic Awardings:
- Diploma of higher education
 - * 3rd mate/engineer or ship electrical officer certificates (Ref. A.5)
 - (sparetime and correspondence education excluded)
- 5) Enrollment and Study Duration:
- Senior high school graduates for Program a) (Ref. A.6)
 - Junior high school graduates for Program b) who have passed the annual state examinations for middle higher technical schools (Regional)
 - existing ocean-going ship watchkeeping officers for Program c)
- 6) Total Students Enrollment: (by 1986)
- 1120
 - (1650 in 1990)
- 7) Teaching Faculty:
- around 250
 - including 30 professors and associated professors
- 8) Teaching Equipment and Installations:
- over 20 laboratories and training stations
 - 4 training vessels
 - 1: 13,000T
 - 3: 500T
 - 1 metalworking factory
- D. QINGDAO OCEAN SHIPPING MARINER COLLEGE (1976)
- 1) Location:
- Qingdao City, China's mid-east seaport
- 2) Features and Specialities:
- a specialised institution of higher learning
 - specialized in:
 - ocean-going vessel navigation technology
 - marine engineering
 - shipping management

- upgrading and updating courses
- well equipped with modern MET equipment
- stress on the English ability and professional skills of the students as well as on acquiring of new technology

3) Departments and Course Specialities:

- Navigation
 - marine navigation
 - a) 3-year program
 - b) 6-month upgrading courses
 - c) updating courses
 - shipping telecommunication
 - a), b) and c)
- Marine Engineering
 - marine engineering
 - a), b) and c)
 - ship electrical equipment management
 - a), b) and c)
- Ocean Shipping Management
 - Ocean-shipping management
 - Ocean-shipping accounting
- Basic Science

4) Academic Awardings:

- (See C.4)

5) Enrollment and Study Duration:

- senior high school graduates (or equivalents) and mariner school graduates, who have no less than 2 years of sea experience or related shore working experience
- 3-year full-time program
- (upgrading and updating courses excluded)

6) Total Students Enrollment

- around 800 excluding participants of b) and c) courses

7) Teaching Faculty

- around 200

8) Teaching Equipment and Installations:

- over 30 laboratories and training stations
- Audio-video Education Center
- Marine Simulation Center
 - large navigation manoeuvring simulator
 - anti-collision radar simulator
 - engine-room simulator
 - automation engine-room
 - goto-planetarium
- Computer Center
- 1 training factory

E. DALIAN MARINE SCHOOL (1950s)

1) Location:

- Dalian City (See A.1)

2) Features and Specialities:

- a higher technical school
- specialised in medium level maritime technology and skills

3) Departments and Specialities:

- Navigation
 - navigation technology
 - ship radio technology
 - Marine Engineering
 - marine engineering
 - ship electrics
 - Basic Science
- 4) Academic Awardings:
- Diploma of Higher Technical School
 - * 3rd mate/engineer certificate (Ref. A5)
- 5) Enrolment and Study Durations
- senior high school graduates who have passed the annual state higher technical school entrance examinations
 - 3-year full-time program
- 6) Total Students Enrollment:
- around 500
- 7) Teaching Faculty:
- around 200
- 8) Teaching Equipment and Installations
- over 20 laboratories and training stations
 - 1 training vessel
 - 1 training factory

**

(Seafaring specialities training Requirements of the above academies:

- at least in accordance with the standards/guidelines specified in IMO/STCW Convention, 1978)
- yearly graduates who are to be seafaring ship officers are around 1000. Half of them join the national ocean-going fleet and the rest join other sectors of the shipping industry.

F. SCHOOLS FOR OCEAN-GOING SEAMEN:

NANJING MARINER SCHOOL

1) Location:

- Nanjing City, Deepwater Berth river port along Yangtze River, mid-east China

GUANGZHOU (CANTON) MARINER SCHOOL

- Guangzhou City, China's southern seaport city

TIANJIN MARINER SCHOOL

- Tianjin City, China's northeast seaport city

2) Features:

- technical schools for training sea-going ship ratings; all graduates join the national ocean-going fleet

3) Specialities:

- Navigation seamanship and techniques, etc.
- Marine Engine service, etc.
- Basic Science

- 4) Academic Awardings:
 - Diploma of Middle Higher Technical School
- 5) Enrolment and Study Duration:
 - junior high school graduates
(3-year full-time courses)
 - senior high school graduates
(2-year full-time courses)
 - (After passing the annual state entrance examinations for middle higher technical schools)
- 6) Total Students Enrollment:
 - over 1000
- 7) Teaching Faculty:
 - over 500
- 8) Teaching Equipment and Installations
 - various laboratories and training stations
 - training vessels
 - training work-shops and factories

II. ADVANTAGES AND PROBLEMS

Generally, China's MET system is modern and dynamic yet many problems remain. Fortunately there are provisions for rationalization and improvement.

1. NATIONAL EDUCATION SYSTEM AND MET

- A. As one component of the national education network, China's MET enjoys the biggest advantage with respect to:
- high calibre intakes through tough examinations of various levels.
 - most of new students choose the specialities according to their own preference and therefore are dedicated to that choice.
 - seafaring specialities are treated as one of the special learnings to cope with uncommon working conditions. The students therefore enjoy more food and uniform subsidies from the national education budget in addition to free tuition and accommodation and other scholarships.
 - all the academies are under the Ministry of Education and the Ministry of Communications, some directly under the nation's ocean-going fleet. They naturally get resources from each authority accordingly.
- B. However, apart from all the advantages, the nation's central planning system left very limited flexibility within the MET academies and gave them little incentive to meet their potential. The newly adopted policy mentioned in Chapter 7 brings hope for quicker improvement and development but it takes time and effort, more than expected. Furthermore, the nation's employment system allows normally only the package training i.e. full-time program, no flexible possibility for half-way in, such as sandwich system, Japanese system or Program 2 in AMTA, Egypt (ref. Chapter 4).

2. MET SYSTEM

- A. From the previous section, one can easily get the impression of the huge training capacity, various, and activities as well as future possibilities of China's MET domain.
- 5 MET academies are engaged in merchant marine officers' training
 - total capacity/enrollment is above 7000 in 1986 and will be about 9500 in 1990.
 - yearly cadet graduate is around 1300 from 1986 to 1990, 800 of them will be able to join the ocean-going fleet.
 - 3 seamen schools are engaged in ocean-going ratings' training
 - total capacity/enrollment is above 1000 at present.
 - yearly graduates is about 500, all joining the nation's ocean-going fleet (vocational high school graduates excluded).
- B. While on the other hand, careful readers will immediately find the lack of rationalization of the whole MET system.
- 1) There are 3 training packages for future ship officers, namely, university package (A and B: 4/5-year to 2nd

mate/engineer level), technical college package (C and D: 3-year, to 3rd mate/engineer level) and higher technical school (E: 3-year, to 3rd mate/engineer level). This status has its own historical reasons, while the long existing problems are that all these three packages are oriented for nearly the same education objectives and have no clear distinctions in curriculum or syllabus. All the graduates start their sea career as assistant watchkeeping officers. The only difference is the salary.

- 2) The most irrational part is that due to the rules and limitations in the present system, some of them have to go back to Qingdao Academy for another three years study in order to get the required diploma of higher learning for future career development and social status as well as basic salary enhancement. There, they repeat most of the courses with seamen school or high school graduates ratings - a big waste of time, money and life in one sense, even though the education is paid by their companies. (To be further discussed in Chapter 9)

3. QUANTITATIVE TURNOUT

- A. Owing to the rapid development of the nation's economy, trade and, the quick expansion of the fleet, there have always been a shortage of qualified seafarers in the fleet, especially after 11-year "Cultural Revolution" when the whole education was partly suspended. China's MET has been enjoying a flourishing time since. Many rational adjustments have been made and improvements achieved to produce a large number of more qualified seafarers for the urgent need of fleet expansion.
- B. However, a potential problem of over capacity is likely to appear in a few years time. (See Fig. 8.3)

Based on the previous analyses and discussions (Ref. Chapter 1-III & IV, Chapter 5, 6 and 7-1), forecasts can be done according to two different manning scales.

CASE 1: (Curve 6.A vs Curve 4 & 5)

On basis of general assumption that the technical departments of each ocean-going vessel are manned with 11 officers and the rest are ratings, with a rotation co-efficient of 1.5, China's ocean-going fleet will finally have a sufficient number of officers between 1987 and 1988. (Retirement and sick-leaves or turnovers have also been considered.) If MET academies go on producing the same quantity of ship officers as in 1986, 1990 will see 17% (2400) oversupply while 26% (4260) and 32% (5900) in 1995 and 2000.

CASE 2: (Curve 6.B vs Curve 4 & 5)

In case of the Double-Crewing policy (Ref. Chapter 6-III) being fully implemented, the equilibrium of demand and supply will not be attained until 1994 to 1998.

CASE 3:

The implementation of the development plan of each academy (20% up to 1990) will mean another 200 graduates more will join the fleet every year from early 1990s, adding another 500 (1995) and 1500 (2000) to the numbers in Case 1 and 2.

(To be elaborated in Chapter 10)

4. QUALITY

- 1) China's MET with respect to higher learnings have always, as other institutions, focused on laying down a solid theoretical foundation, with due attention paid to technical skills. But more often than not by subconsciously following the traditional concept, theoretical knowledge is more preferred than technical skills; academic ability is more appreciated than managerial ability. MET students, like those in all other scientific studies, have gone through heavy subjects of pure science in advanced mathematics and physics, etc. 3-year programs take almost the same teaching hours as the 4-year program (e.g. 2262 and 2240+260*) (* optional subjects). At the end of the day, new graduates usually find themselves armed with sound theoretical knowledge and insufficient practical skills to cope with day to day shipboard performance.
- 2) New technology and new developments are only gradually introduced into the syllabus, but this is usually done with such a time lag that the technology has already become popular. As mentioned before, the MET's major objective is to prepare both the brain and hands, therefore, it is essential for the academies to keep pace with or keep ahead of technological development
- 3) English language abilities has always been a weak point of many Chinese seafarers and often affect safe and efficient ship operation. This is a direct consequence of the previous disorder in the nation's education system though MET has focused on it in recent years. In addition to the big difference between English language and Chinese, the nation's general education system and the close-door policy before 1980 had failed to provide all pupils with sound basic English language ability. What is more, there had been a lack of co-ordination of English courses given on different levels of education. It was not rare to see college students start with the "ABCs..." - for the third or fourth time in their whole school life. The situation however has been improved. Hopefully, in the 1990s, new enrollments will be able to receive advanced and professional English courses solidly based in the general education system.

(Chapter 11 will be devoted to issues concerning quality.)

5. TEACHING FACULTIES

Due to historical reasons and traditional practice, China's MET teaching faculties are mainly composed of people with high academic ability, sound theoretical background but they lack real maritime experience if we exclude short duration on-the-job training and training vessel experience. Few master mariners or chief engineers have ever considered leaving the sea for an MET career. Young teachers are single-mindedly driving for higher academic degrees since the new rules have made it compulsory, while elderly teachers have started to suffer from obsolescence of their knowledge.

In short, as a most decisive factor in education and training, the total MET faculty have long been confronted with the lack of proper balance in age structure, post structure, academic degrees and expertise structure, knowledge structure and intellectual ability structure. These, in addition to the ineffective exchange and communication in and out of the domain, remain as serious issues.

(For further discussions please see Chapter 12.)

6. (The question of teaching equipment and MET environment is to be discussed in Chapter 13.)

Fig. 8.3A THE WORLD AND CHINA'S SEABORNE TRADE AND MERCHANT FLEET

(INDEX 1980 = 100)

- WORLD SEABORNE TRADE VOLUME (TONMILE) (Ref. Fig. 1.2)
- CHINA'S SEABORNE FOREIGN TRADE VOLUME (TON) (Ref. Chapter 5 & 6)
- WORLD MERCHANT FLEET (IN NUMBER) (Ref. RB 3.1)
- - - CHINA'S OCEAN-GOING FLEET (IN NUMBER) (Ref. Chapter 6)

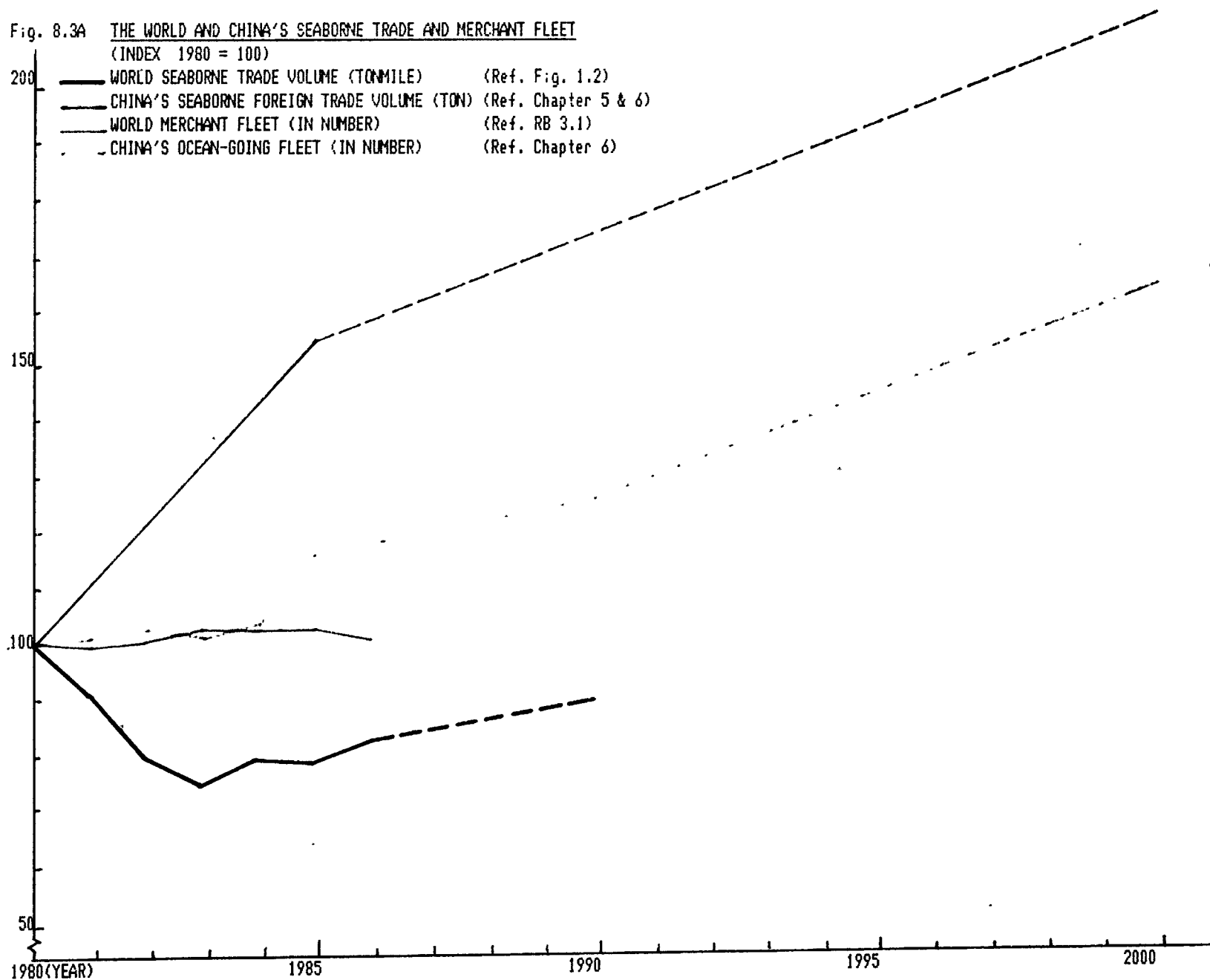
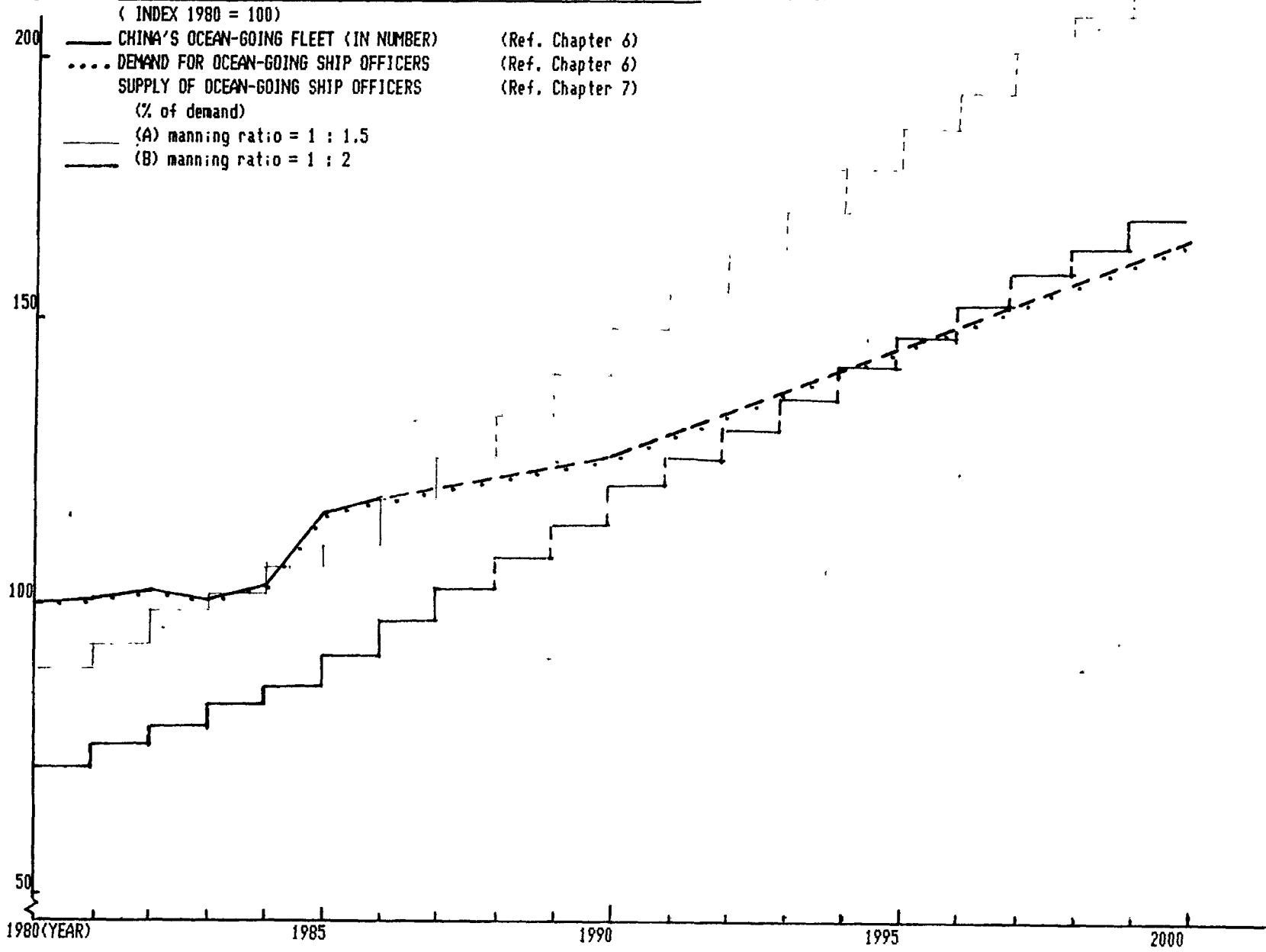


Fig. 8.38 EVOLUTION OF DEMAND AND SUPPLY OF OCEAN-GOING SHIP OFFICERS (CHINA) (1980 - 2000)



TOWARDS A MORE RATIONAL MET SYSTEM

I. NECESSARY STRUCTURE REFORMATION

The essence of manpower planning and higher/vocational education is to prepare the right number of people with right qualification at right time.

A rational structure of the whole education system and all its sub-systems is the first requisite, especially in respect to China's development in a long run. A carefully structured and well co-ordinated MET system is without exception fundamental for a smooth nurturing of qualified seafarers at all levels to meet the present and future demands.

Conceptually speaking, a good system must have both stability and the flexibility to accommodate change brought about by changing circumstances. From the micro point of view, a good system is also a system that does not limit the development of the students' potential nor the system potential itself. In this two respects the experience of Japanese MET system and Egypt Arab Maritime Transport Academy are worth referring. (See Chapter 4-D)

As analysed in Chapter 1, 2 and 3, shipping is becoming more and more capital intensive and technology intensive thus naturally personnel knowledge intensive. However, as discussed in Chapter 4, seafaring by and large is more of an applied science involving a large proportion of skill and experience plus constant upgrading and updating. A good MET structure should be able to accommodate all tiers and all types coherently to the industrial and developmental needs. The present one has brought some confusion, friction and repetition. The need for certain restructuring has been a issue for years.

To be practical and easily accessible, the following rearrangements would be ideal in a ten-year term. Figure 9.1 is a planning diagram of the new structure based on the following considerations and assumptions:

- It does not involve any change in administrative subordinating relationship and commitment accountability of each academy nor its geographical location since it is nearly impossible in the short term.
- The Ministry of Communications and its departments concerned co-ordinate the whole MET sector, the MET and other ministries as well as the MET and the whole maritime domain.
- Take the nation's present educational structure reform scheme as guiding principles.

1. Tiers and Types

A. University Level (comprehensive)

- Dalian and Shanghai maritime academies
(Chapter 8-I-A & B)

A.1 4-year program for senior high school graduates or middle higher technical/vocational school graduates

A.2 5-year dual-purpose ship officer program for small percentage of higher achievement students of seafaring speciality selected after the "common first year" (To be further discussed.)

A.3 Postgraduate programs - open to all willing learners who fulfil the requirements concerned. Seafarers are given sea experience compensation marks for enrolment.

B. Technical College Level

- Jimei academy and present Dalian Maritime School (Chapter 8-I-C & E)

B.1 3-year program for senior high school or middle higher technical/vocational school graduates

B.2 5-year program for junior high school graduates

C. Vocational College Level

- Qingdao Academy

C.1 3-year program for ratings from seamen schools or senior high school graduates (sea experience is required)

C.2 Upgrading programs and Updating programs for shipboard personnel

D. Middle Technical School Level

- various seamen schools (Chapter 8-I-F)

3-year program for junior high school graduates

**

- All enrollments are done in accordance with the corresponding national examination schemes.
- All academic awarding upon graduation are in conformity with the corresponding national schemes.
- All seafaring speciality graduates get their respective Certificate of Competency on passing the certificate examinations co-conducted by the academies and the national authority concerned. The certificate will be valid only after the holder has fulfilled the sea service required.

2. Education Focuses and Objectives

A. University Level

This level of higher education gather the young people of highest academic ability, one out of five senior high school graduates. Dalian and Shanghai academies are both of comprehensive maritime institutions and are in addition entrusted with a developmental role in the shipping industry. The education emphasis should be on both research and higher level management. Future researchers or lecturers usually go through postgraduate courses, while future senior managers aboard or ashore may get necessary practical experience before they go back for upgrading courses, updating courses or postgraduate courses. Potential of the students should be carefully and fully cultivated accordingly.

B. Technical College Level

The stress should be on operating skills of the future ship officers. Each of them should be an expert in his post and competent manager of his level with a good understanding of the whole system. The doors of further academic or career development are always open to them at A and C level academies.

The philosophy behind the 5-year program is to cultivate seamanship when the cadets are young and more plastic. They are more adaptable and will stick to the seafaring career if properly fostered.

C. Vocational College Level

C.1 This program is open to seafaring ratings with the similar education focus as B. Since the age of the students are comparatively more matured and have some sea experience to back them up. More managerial ability can be cultivated.

C.2 This consists of short courses of all kinds and all levels. Durations can vary from few days to one or two years according to the course feature and requirement. This should become the major tasks of the Qingdao academy, for without this part, maritime education and training can never be a complete picture.

D. Technical School Level

Seafaring ratings are trained with stress on seamanship and basic ship knowledge in addition to necessary general education. Introductory short courses for newly recruited ratings from senior high school graduates are also trained here.

3. Quantitative Proportion of Enrollment
(Ocean-going population only)

3.1 Future Officers - 50%

A: 15%

B: 30%

C: 5%

3.2 Future Ratings - 50%

D: 50%

11. OPEN TO THE WORLD

China's education has, to this time, been geared to her internal needs. So is MET, which is from now on facing potential overcapacity in the sector of seafaring speciality. The possible oversupply requires careful readjustment and replanning.

1. To reduce the enrollment?

No. As is shown in Chapter 7, the 1990s will see China facing the peak period demanding for higher/vocational education and employment, over 13 million every year. All the higher and vocational education sectors will be encouraged or obliged to exploit and utilize the potential to the full.

2. To diversify?

Yes. This is what is happening in the two maritime universities. As has been illustrated in Chapter 8-I, only 1/3 of their graduates join the ocean-going fleet every year. However, this is not enough in terms of quantity.

3. To educate for the world market?

Yes! It is a very positive approach, which has been taken for years in many lower labour cost countries, such as India, Korea, Pakistan, the Philippines, etc. Take the Philippines for example, 3000 to 5000 cadets graduate from her 43 MET institutions every year, of which only 5% are joining her national fleet. 95% are exposed to the world market, being recruited onboard foreign flag ships, generating constant foreign currency inflow for the country.

As has been intensively discussed before the world will see a smaller number but more advanced ships trading across the oceans in the 1990s. More than 50% of them will be registered under all forms of international open registries, forming a major market for low-cost seafarers of higher quality.

It is high time for China to enter into the market, in which she enjoys many unique advantages:

- 1) Her "low salary, low price" policy provides a solid base for lower labour cost;
- 2) Her free education and high quality enrolment scheme coupled with sound academic and professional education programs produce higher quality seafarers as is the case of Poland and USSR.
- 3) The social welfare system covers every citizen, including people employed to work abroad and their families, which provides a secured social backdrop.
- 4) The nature of her employment system provides an easier access to the working and education record of an individual seafarer. This is one of the important factors concerning the shipowners of the world.
- 5) Above all, it has recently been highlighted as one of the country's promotional objectives to contract for more construction projects and labour services abroad. As is mentioned previously, this is taken as three-fold beneficial engagement and in addition (for the national fleet) to increase the competency and competitiveness of the national fleet through the rotation of the national seamen onboard foreign flag ships when more of them become

open-minded and accustomed to the operation of advanced ships.

Adding all this together, China is in a position to be very competitive in the international seafarer market. The questions are to get to know and to get known to the market. The justification and market development can only be obtained through the quality of the seafarers in addition to the quality of labour export management.

III. LOOK INTO THE FUTURE

Looking into the future, the Dual-purpose training program can be introduced into China's MET system on a small scale as a developmental experiment. Unlike the major purpose of those high labour cost countries to cut manning cost, the sole purpose of such program in China's MET should be focused on nurturing more competent seafarers for the future:

- to add an active element to the shipboard management team to attain better performance
- to prepare future management personnel
- to prepare better qualified shipboard personnel for the competition in international seafarer market, particularly for the job opportunities on board those technically-advanced ships with tight manning scales. The opportunities exist for those who are ready.

Practically speaking, it is the first two points that will justify the necessity of the program. A small number of students can be selected after the common first year to join a 5-year Dual-purpose program (1st year included). The education can either be done through tailor-made programs or like the US practice by co-ordinating the students into the programs of the two departments. During the sea training, the students must take both disciplines. Two months more can be added to ensure a desirable result. Upon graduation the successful student will get his Bsc degree plus 2nd mate and 2nd engineer certificate (equivalent to postgraduate diploma) and goes onboard to serve the discipline he prefers.

Why 5-year program? If we further analyse the advantages and disadvantages of the dual-purpose program, we would find that most of the disadvantages stem from compressed course curriculum in a comparative short period of time. To prepare future management personnel, sound background knowledge and a broad view is a must.

Here, the Canadian experience is worth reviewing. Canada was the first nation that tried the dual-purpose program. It was done in the 1950s. Only 50 persons completed the studies before the program was given up. Thirty years later, all of them are found in the top positions of the country's shipping circle. Obviously, it is the broader overview and higher working capacity that has made them more competent managerial personnel.

The US experience has produced similar results, i.e. that this group of students and graduates appear to be more goal-oriented and system-minded. They are highly motivated and disciplined to do the work. They can accomplish a great deal in a short period

of time and are more ready for the co-operative world despite the fact that they are somewhat aloof and tend to group together on campus.

IV. MARKET PARTICIPATION

Under the central planned economy system, educational institutions have never had much interaction with the markets. Nevertheless, during the country's economic development, the market mechanism is going to be gradually introduced into the previously untouched fields such as:

- technology and equipment
- finance
- information
- manpower, including:
 - a) scientists and technicians, know-hows and experts
 - b) labour force.

Likewise education will have to adjust itself actively according to the market demands in terms of quantity, quality and time. Market studies must be carried out and co-ordination done accordingly to enable a constant effective adjustment and produce the right number of people of right quality at right time.

CHAPTER 10

QUANTITATIVE PROVISION

This is a question directly to do with future employment/unemployment and education resource allocation. From previous analysis, we can easily foresee that in the next ten years China's MET will be confronted with a very dynamic market, while the minimum time lag of MET is 2 to 3 years for a watchkeeping officer, 8 to 10 years for a captain or chief engineer and 10 to 15 years for a shipping company line manager.

Internally, the MET planning authority must keep in close contact with the fleet planning division and manning division to coordinate the enrollment and training plan.

Externally, the MET must participate in the general market forecasting of the prospects for seafarers' employment opportunity on board foreign ships. This is a highly dynamic market where demand elasticity is very high and totally independent of supply.

Nonetheless, from the curves shown in Fig. 8.3 and the quantitative analysis done in Chapter 8-II-3, that possible internal oversupply could be 0 to 2400-2600 by 1990, 0 to 4200-4700 by 1995 and 1000 to 5900-7400. If the new manning policy can be smoothly implemented step by step according to the circumstances, the oversupply curve can be finalised in the middle (1000-2500) thus providing an ideal supply for the external market before 1995. The picture however is an ever changing one and several readjustments may have to be made in the planning system accordingly.

From the viewpoint of market regulating, it is better to have a small and controllable amount of oversupply in the market to stimulate efficiency and healthy competition. It is good for both fleet manning management and individual competency enhancement.

From the MET planning point of view five sections should be well coordinated and treated separately.

To repeat the proposed Quantitative Proportion of Enrolment for Seafaring Specialities: (Chapter 9-I-3)

- Future Officers (50%)
 - University Level: 15%
 - Technical College Level: 30%
 - vocational College Level: 5%
- Future Ratings: (50%)
 - Technical School Level: 50%

1. Seafaring Specialities (University Level)

The present yearly enrollment of 600 can remain constant. A small number of half-way-in senior students can be accepted under the condition of enrollment by commission from industries or self-support provided they meet the requirement and be enrolled.

2. Other Shorebased Maritime Specialities and Postgraduate

Studies (University Level)

As developmental sections, the social demand is high in the years to come. Quantitative expansion will be a real need based on the quality enhancement and therefore should be done according to the capacity attainable.

3. Seafaring Specialities

(Technical/Vocational College Level)

The present yearly enrollment of 500-600 can be retained without further expansion. The new 5-year program for junior high school graduates needs careful cultivation and means a big increase of total number of cadets under study which demands bigger training capacity.

4. Refresh/Upgrading/Updating Courses

This is an area that needs great attention and development. Present programs are mostly ad hoc and do not have schematic coordination. By the year 1990, the present fleet readjustment and education reform will be giving good results. The MET should also be ready for all kinds of short courses at all level to meet the constant training needs and to respond to technical/shipboard changes/developments. As has been discussed above, the demands for retraining are increasing and its value is more and more appreciated and easily justified.

5. Ratings/ Training (Technical School Level)

The present enrollment cannot cope with the increasing needs of skilled and well-trained ratings despite the fact that shipboard officer/rating ratio is decreasing from 1:2.5 to 1:1 or less as a result of technology development. In the next ten years, the yearly enrollment needs to increase to 800-1000 which needs a 2500 to 3000 total accommodating capacity. However, there is no need to set up any new training institutions. As for the momentary insufficiency in capacity, help can be provided by Talian Maritime School/College and the various training centers run by ocean shipping companies.

Quantity of supply is a dynamic factor that fluctuates in accordance with demand. To prepare for potential future demand is a very challenging task that has little room for negligence or assumptions based purely on previous experience. This is especially so when planning for the seafaring specialities which are less substitutive or less diversifiable.

QUALITY ASSURANCE

I. BASIC QUALITY/ATTAINMENTS

Quality of the seafarers together with the quality of the management ensures the productivity and the competitiveness of the fleet. But "quality" is something very relative and abstract and changes with the passage of time. Generally speaking, relevant MET should be able to ensure to its graduates the competency necessary to meet their respective job requirements and their adaptability to the technical and environmental change. This is in addition to the basic attributes of seafarers such as discipline, sense of responsibility, determination, endurance, spirit of co-operation and international mindedness, etc.

Before going into details, we may discuss firstly some of the quality elements that will be indispensable in a future seafarer's outlook and insight in addition to traditional and disciplinary features.

Firstly, a basic sense of law, economics, efficiency, safety, management science and systems concept should be instilled into the future seafarers. This was a weak or neglected sector in China's previous education system. The MET section was no better in this respect, even though its task has been to serve the country's shipping industry, which is deeply involved in the international competition.

Efficiency is the basis of effectiveness/productivity. The history of human civilization is in fact a history of efficiency revolution. The present and future technological revolutions are without exception new waves of efficiency revolution. There is no doubt that the future belongs to the most competent and the most efficient. Driving for efficiency has been a key to the rapid development of advanced countries. Competition provides an environment to push/force every one ahead. All this could also be a key to China's economic and social reform and development.

To increase efficiency actually means to increase the efficiency of each individual. To obtain this we must first of all help everyone, including ourselves, to set up the scientific concept of efficiency which includes efficiency objectives, new concepts of time, of value, of competition, of production, of working, of property and of leadership, etc. The collective outcome of this will be in reducing the input and increasing the output and its quality, in business jargon - "to minimize the cost and maximize the profit".

Law, in many practical cases, means the national and international standards and criteria that one should behave in accordance with.

Economics is the hidden axle of the present world. Previously few China's mariners were aware of the economics of sea

transport. By contrast the subject is taught at the level of seamen's school in Japan because they believe it will contribute to a better shipboard performance and to fleet competitiveness and as certainly proven to be correct.

Safety is the first prerequisite to enhance productivity. Its social, economic and political impacts are much greater than would appear.

Management science embodies scientific principles to aid pursuit of operational efficiency with regard to the achievement of objectives. This also underlies rational allocation, co-ordination and co-operation of all resources - material, manpower, knowledge, technology and environment.

All these factors, together with the background knowledge, and technical knowledge, and skills combine to create professional knowledge. The actual competency and expertise of a seafarer is the combination of the professional knowledge and working experience. The MET is responsible for the first part - sound professional knowledge and basic operational skills. The adequate ability of seafarers consists of the practical applicability of the knowledge and the proper mental attitude. This is the base for competent performance, lack of which the seafarers will run counter to our expectation of safe and efficient operation of ships.

II. KNOWLEDGE STRUCTURE (For seafaring specialities only)

A. General

As far as the knowledge structure is concerned, it should be decided by the specific objective of each MET program. Common to all, it should be sound, wide and well-designed to cope with the three very basic immediate and potential needs already discussed above. (Chapter 4-II-B)

The syllabus and curriculum ought to be periodically revised to reflect the development of technology and keep a good balance between the general sciences and specialized knowledge. Balance should also be sought between theory and experience while keeping in mind traditional subjects and values.

Knowledge of electronics, control automation principles, and computer technology - especially data handling also the shipboard system networks are vital. These plus maritime law, shipping economics and shipboard management should be given to all students. Depth depends on each specific program.

"Common first year" should be introduced to seafaring programs at both university and technical/vocational college level. (For justification, please refer to Chapter 4-II-B.) In short, better understanding of both disciplines within the whole system, plus an open-mindedness and a good spirit of cooperation in team work always contributes to a safer and more efficient ship operation, particularly modern ships.

The knowledge and skills related to the highly critical tasks, and those infrequently performed aboard ship should also be given in addition to professional routines.

For the future deck officers, apart from sound navigation knowledge, skill and modern seamanship (Ref. Chapter 4-II-B), more engineering knowledge should be added in the curriculum so as to get them ready for coping with a more engineering oriented type of navigation work and overall shipboard operation.

For the future marine engineers, automation, systems engineering, electronics and computer technology together with trouble shooting and maintenance knowledge and ability should be stressed based on the sound general engineering background plus operation economy and operation engineering.

All these important new subjects impose great challenge to the traditional syllabi and curricula. Efforts should be made to obtain a rational combination and balance based on the real understanding of specific MET objectives.

B. University Level

The education focus and objectives must be to nurture future ship officers and fleet management personnel. The research ability and potential of this high calibre group should be carefully and fully cultivated.

Close links with the industries and professional research institutes should be established and made use of to enable the students as well as the lecturers to be aware of the developments and potential of new technologies and to participate in the research involved. In this way, the system will be able to initiate development from within.

The knowledge structure designed for these students should have the following features:

- deep
- wide
- new
- solid
- system oriented

As for the course modules, Table 4.9 (A) and (B) offers some possibilities. Weighings, depth and proportion can differ according to each speciality.

(A) Total Ship Operations:

1) Ship Safety

Safety Administration. Specifications for life saving and safety equipment. Practices in equipment use. Safety awareness and control.

2) Pollution Control

National and International Legislation. Specifications for pollution control equipment. Health and sanitation. Combating pollution.

3) Ship Construction and Design

Builders and owners responsibilities. Approval by Administration and Classification Societies. Design Procedures and practice. Materials, use and limitations.

4) Ship Maintenance

Principle of maintenance. Techniques of condition monitoring. Trend analysis and maintenance planning. Shipboard Surveys (continuous). Principles of wear and corrosion control.

5) Ship Handling

Navigation and position fixing techniques. Ship dynamics and manoeuvring. Collision prevention and Traffic management. Passage Planning. Berthing and docking.

6) Cargo care and handling

Ship stability and stress considerations. Cargo segregation. Handling systems. Procedures and practice. Cargo monitoring and inspection.

7) Communications

Elements of communications. Methods and technology available. Security and practice. Ship-shore linking.

8) Man-Machine Interfacing

Principles of ergonomics. Information transfer techniques. Stress factors. Work science.

(B) Total Ship Management

9) Maritime Transportation Law

Liabilities. Charter Parties. Salvage and Arbitration. Insurance.

10) Maritime Transportation Economics and Safety

Codes of practice. Ship and Cargo brokerage. Conventions in operation. Classification of hazardous and dangerous goods.

11) Environment Protection

Codes and conventions. Control procedures. Records and documentation.

12) Developments in Maritime Technology

Energy conversion systems. Ship handling and control systems. Cargo transshipment. Ship design and construction.

13) Techniques of Total Resource Management

Principles of Corporation Management. Defining and evaluating goals. Value Analysis. Resource availability and maintainability. Preventive maintenance techniques. Documentation.

14) Search and Rescue

Distress and assistance communications. Ship communications equipment and systems. Search and rescue manual. Medical assistance facilities and systems.

15) Personnel Management and Human Relationship

Working conditions. Labour organization and unions. Human interaction and performance.

16) Accident Investigation

Legislation and regulations. Procedures and evaluation of evidence. Human factors in accidents. Remedial actions.

- 17) Ship Survey and Inspection Requirements
Influence of conventions. Role of administration and classification surveyors. Technical regulations. Principles of continuous survey.
- 18) Damage Control and Integrity Maintenance
Special ship construction requirements. Safety and fire prevention. Emergency procedures. Ship evacuation.
- 19) Applications of Information Technology
Aids in management and record keeping. Data display system. Data transmission and communications. Computer technology and applications.

Module 1 to 10 plus 18 should be dealt in depth and detail while the others should be duly introduced. Depth and detail vary according to the practical needs and preference and should be offered in the form of optional courses. Further studies can be offered in upgrading and special short courses.

C. Technical/Vocational College Level

At this level, education and training should be concentrated on operational skills. Course module 1 to 8 should be stressed and coupled with practical experience. The contents of course modules 9 to 19 can be duly selected and introduced to the students with the aim acquainting them with the whole system, their interrelations, and new development.

Thanks to the low manning cost advantage, the national fleet will continue to apply self-maintenance policies and planned maintenance programs on board the ships. The foreign shipowners who choose international manning strategies will apply the same principles. Therefore students should be well prepared/equipped with maintenance and repair knowledge and skills, including both the traditional mechanical skills and the newer automation techniques. The planned maintenance program, in particular, demands higher knowledge and skill otherwise the danger of building in new faults may lead to a possible catastrophe.

For the vocational college students, deeper theoretical knowledge can be given since they have the advantage of previous sea experience and middle level vocational/technical education. More courses in ship management (B) 9 to 19 can be introduced with proper depth.

Retrainability of students should be duly examined upon enrollment.

D. Refresher/Upgrading and Updating Courses

These courses can be modulized and divided into five major categories, namely:

- 1) certification courses (basic and upgrading)
- 2) safety courses
(Ref. Chapter 4-II-B and Chapter 6-III-2-B)
- 3) regular refresher/updating courses (training in rotation)
- 4) special courses dealing with specific topics and new developments e.g. tanker safety, ARPA, VHF, VTS communications, law, economics, conventions and regulation introduction and interpretation, shipboard management, management, etc. including also all the subjects listed in Course moduls (A) and (B), particularly (B).
- 5) senior courses for future captains and chief engineers
 - 1-year course for technical/vocational college graduates
 - 4-6 month course for university graduates
- 6) senior management courses for future fleet or shipping company line managers

All the courses are modulized and interchangeable according to specific training needs. The purpose is to provide flexibility and updated courses to suit the ever developing needs from the industry thus to keep the seafarers competent and the fleet competitive.

E. Technical/Seamen School Level

Training schemes for General Purpose Ratings (GP) should be introduced into all seamen schools. For justifications please refer to Chapter 3-II and Chapter 4-II-B and 4-I-D-(1).

F. English

Foreign language is an indispensable medium for culture, trade and technology exchange between countries. Its role in a country's development can never be overestimated. English language communication and reading skills are one of the most important components of a seafarer's professional competency. It directly affects the competitiveness of the Chinese seafarer in the international market.

Great efforts towards improving foreign language teaching and training started on a nation wide scale around 1980 when the "open-door" and economic reform policy was adopted. Since then remarkable improvements have been achieved. The 1990s will quite possibly see China's general education providing new generations with sound basic foreign language education and paving the way for a higher level of language training and education at college level.

A new University English Syllabus was implemented from 1985. It is an advanced and detailed syllabus with the following features:

1. Emphasis on the common language core between general English and English for Science and Technology (EST).
2. Stresses on the communication skills based on sound language ability.
3. Stresses the fluency in English.

Emphasis on reading comprehension (intensive and extensive), fast reading skills as well as listening and speaking skills,

plus translation and writing skills. The qualitative and quantitative standards for each skill are specified. However, requirements on each ability may differ according to the practical needs of the speciality concerned.

4. Carry out LEVEL teaching, examination and certification. Six levels are defined and each has its own curriculum suitable for different level and language learnability of each individual student.
5. Make Professional English Reading a compulsory course to ensure the skill and its continuous practice.

In the Maritime English sector, 300-450 lecture hours are devoted to English teaching in both 3-year and 4-year programs. More English version text books are used in professional courses.

Actualization of this syllabus through the endeavours of the language teaching staffs in all the MET academies using appropriate methodologies, teaching aids in a healthy environment will doubtlessly enhance the overall competency and competitiveness of the new generation of Chinese seafarers.

CHAPTER 12

OPTIMAL STRUCTURE OF MET TEACHING STAFF

It is indisputable that the effectiveness of MET programs and the quality of a country's MET is dependent to a significant extent upon the competence, qualification and commitment of MET teaching faculties. The reputation of a maritime training institution, its value for the industry, the administration and the national economy are closely related to the qualification of its teaching/researching staff. This is one of the four criteria to evaluate an academic institution. The other three are: teaching equipment, library and management.

1. THE QUALIFICATIONS

1. Optimal Calibre of Each Faculty Individual Lecturer

Apart from the basic professional ethics and qualities as a lecturer in the higher education field (i.e. physical, mental, moral and intellectual) the optimal calibre/expertise of a maritime lecturer is a intimate combination of knowledge base/structure, intellectual capacity, andagogical/pedagogical ability and expertise.

The necessary expertise consists of the following criteria:

- background knowledge
- academic capacity
- pedagogical capacity
- shipboard/industry working experience

Sound knowledge base/structure requires a wide and solid background knowledge and systematic professional knowledge, including necessary knowledge on adjacent specialities and social science as well as good knowledge of English and one or more other foreign languages.

Refined intellectual capacity includes the faculties of observation, attention, memorization and thinking in teaching and other academic activities. Included also are the capacities for analysis, criticism, and synthesis.

Andagogical/pedagogical abilities includes those of oral expression, knowledge imparting, organizing and initializing, plus adaptability and self-enhancing capacity.

2. Optimal Collective Faculty Structure of MET Teaching Staff

A group of excellent individuals does not automatically mean a qualified and productive collective. Here, $2 + 2$ may be equal to 4, less than 4 or more than 4. It all depends on whether an optimal collective structure can be obtained on the basis of optimal individual intellectual faculty structure and whether an esprit de corps can be built thereupon.

In addition to the academic features common to all higher

education institutions, maritime education and training has its own special features. They are:

- knowledge comprehensive,
e.g. nautical speciality needs not only navigation, seamanship, engineering, electronics, computers and other technological knowledge and skills but also good knowledge on law, economics and management science as well as foreign language, so on and so forth.
- more practically and operationally oriented
- international by nature.

An optimal teaching faculty, therefore, must be composed of lecturers and teaching assistants of the following three types apart from the aforementioned basic qualifications:

- theoretical/academic type
- operational/managerial type
- combined type.

a) Theoretical and academic type

They are mainly from various academic institutions and have sound special knowledge and some seafaring/industry experience, who eventually acquire higher academic degrees, i.e. Master, Doctorate or Post doctorate. They may continuously deepen their academic attainments, follow the latest technological developments and trends in their respective fields thus contributing to research and theoretical studies.

b) Operational/managerial type

This group of lecturers are former master mariners or chief engineers and other experts from maritime fields with rich operational experience and high managerial ability.

c) Combined type

They usually combine the merits of the above two types, i.e. sound academic attainments and rich practical experience.

A rational combination of the three groups will make the teaching faculty a highly competent collective with adaptability, creativity, feedback enhancability and complementarity. Table 12.1 and 12.2 are two examples of such combination.

II. STRUCTURE OPTIMIZATION

To build and keep up a competent MET teaching staff takes both time and painstaking efforts. For the years to come, great efforts should be made on structure rationalization of China's MET teaching faculties.

A. Optimize the Collective Structure

As pinpointed in Chapter 8-II-5, the shortage of the operational/managerial type and combined type of maritime lecturer has been undermining to a certain extent the final MET result despite the dedicated commitment of the whole MET teaching staff.

To put this imbalance right, the following measures may be taken:

1. To attract more experienced senior ship officers and industry expertise to the MET fields.

Here, the salary is one of the most important factors in the attraction of maritime lecturers besides the wish to teach and to stay ashore. Other factors such as the reputation of an MET institution, working conditions and scholastic or career development promises, etc. are also important. If the post salary of a senior lecturer can be raised as high as that of senior officers through statutory or institution rules supported by other practical and academic advantages, more ship officers and industry experts will be possibly attracted.

The advantage of acquiring the combined qualification should also be represented in salary.

2. To create more opportunities for MET lecturers to work on board ships or in the maritime industry for a longer period to get them acquainted and reacquainted with ships, equipment and operation procedures, the shipboard/industry reality and problems. It would be more beneficial for both sides if the lecturer goes with a particular task in mind i.e. research, investigation or consultancy.

This approach is comparatively more applicable where it has the full support of the shipping industry. In fact this support is essential.

3. To invite more part-time or visiting lectures from the industry both at home and abroad. Careful selection and necessary remuneration should be duly made.
4. To encourage exchange of expertise and professional co-operation among departments, institutions and between academies and research institutions or industries (both aboard and ashore).

B. Encouragement of Professional Development

The changes in the industry and the resulting demand for advanced training require maritime lecturers to keep abreast of developments and to give continuous attention to updating.

Professional development of individual lecturers was previously left to individual desires and activities. Now more professional developments are initiated by the institutions though not well organized as of yet.

It is necessary to have an overall plan which includes monitoring maritime developments and compares resulting training requirements with expertise available in the teaching staff. This will illustrate the need for updating. Coordination with the individual lecturers' identification of the developments and new training requirements in their field of expertise will provide the prerequisite to an optimal professional development for both the individual and the collective.

The following methods of updating can be used simultaneously to

get the best out of each. Sabbatical leave should be actualized and utilized towards similar ends.

- Self-studies
- Shipboard and/or maritime industry/administration experience
- specialized updating programs
- more exposure to the world

1. Self-studies

The motivation of the individual has to remain the main driving force behind updating activities. Appropriate incentives and encouragement should be given to this individual approach. It would be desirable to render due guidance, concern, task or project co-ordination as well as the final evaluation and corresponding awards by the working unit and institution concerned.

Since 1980, all college lecturers are required to obtain the minimum equivalent of Masters degrees. Young probationary lecturers therefore are single-mindedly pursuing these requisites since these programs have the toughest academic entrance examination—averagely only one out of ten can be enrolled. The Master degree programs are mostly very theoretically oriented that do not match the MET teaching requirements very well.

A better solution lies in a more rational arrangement, specially designed for the young lecturers, who represent the future of a country's MET. Instead of rigid academic procedure for getting Masters degree, a credit system and project plus thesis approach can be adopted. Usually only a few graduates will be selected out of the hundreds. They should be entitled to certain examination exceptions and be naturally accepted as external or on-the-job degree-learners. (Just this simple arrangement will attract more willing MET lecturers.) The study period and method can be more flexible. For certain compulsory subjects, they can take the courses available in and out of the institution until they get the required credit. Meanwhile, they may pursue certain research or investigation projects related to their branches under the guidance of an appointed tutor/mentor until they complete and pass the defense of their theses. Pedagogical training and practice should also be counted in credits. The advantages of this approach are obvious:

- more attractive
- more flexible and adaptable schedules
- better utilization of the available spare time for each individual
- closer link between the studies/research and teaching/professional reality
- relaxing the shortage of teachers
- contributory to initiating young lecturers and guiding them along

2. Shipboard/industry experience (Please refer to II-2 of this chapter)

3. Specialized updating programs

There are more than 2000 MET lecturers and teaching assistants working in the MET institutions in China. This

illustrates a very practical and constant need for organization of regular updating programs and setting up of a MET lecturers' training institute within the domain of the two maritime universities, Dalian and Shanghai academy, where postgraduate courses are already available in their postgraduate institute.

The programs can be incorporated into the existing postgraduates course modules, making full-time, part-time or spare-time studies possible and be combined with field studies. This is a very cost-effective approach and only more effective administrative work is required.

4. More exposure to the world
International-mindedness and more academic exchange/experience at an international level are very important for both the individual and collective quality of the MET teaching faculty. "To invite in and to go out" or exchange program should become constant activities to expose MET staff to the international environment.
 1. To invite in
 - a) more foreign experts/lecturers should be invited in to conduct seminars, lectures or to impart experience
 - b) to organize more international conferences in China, especially IMLA conferences and its workshops.
 - c) the World Maritime University Dalian Branch and other training courses for oversea students should be explored and run to the full to attract more oversea trainees and training projects.
 - d) invest more on information media such as books, publications and audio-visual education materials, etc.
 2. To go out/sabbaticals
 - a) to work on board ocean-going vessels
 - b) to work as staff members or visiting scholars in shipping institutions abroad
 - c) to participate in international conferences, seminars or other meetings
 - d) to send, through all possible means and channels, more lecturers abroad for longer terms and higher degree study/research, especially to the higher MET institutions such as the World Maritime University. There the most comprehensive, specialized and self-contained two-year Msc Degree training program for maritime lecturers (Maritime Education and Training-MET) is offered in addition to other programs for maritime affairs such as Maritime Administration-GMA, Maritime Safety Administration-MSA, Technical Management of Shipping Companies-TMS, etc. One unique feature of the programs is the internationality of the students and faculty bodies. More than 100 nationalities have been represented. Students and lecturers from both developing and developed countries work together to the common goal of improving shipping industry and international co-operation so as to contribute to maritime safety and marine environment protection. Another special feature of the programs is the

beneficial possibilities of field studies and on-job-training in various countries and institutions where students observe the actual functioning of the maritime industries and gain first-hand knowledge about the existing systems, approaches and technology developments in the related aspects/sectors.

Effective exploitation of all these avenues will indeed bear fruit in enhancing the quality of China's MET faculties. The end result, of course, will be quality enhancement of China's maritime education and training.

Table 12.1 Qualification Requirements for MET Teaching Faculty (Massachusetts Maritime Academy, U.S.)

	Lecturers for Basic Science		Lecturers for Professional Courses	Experience (year)
	Qualification	Teaching experience	Qualification	
Lecturer	Master Degree	0	2nd Officer/Eng. + Bsc	2
Assistant Professor	Msc + 30 credits in Reseach institute	3	2nd Officer/Eng. + Bsc + GS Capt./Chief Eng. + Bsc	3
Vice Professor	Doctorate	6	2nd Officer/Eng. + Msc + GS 1st Officer/Eng. + Msc Capt/Cheif Eng. + Bsc Msc + 30 credits at research inst.	6
Professor	Doctorate + PR		1st Officer/Eng. + Msc + GS + PR P.E + Msc + PR Capt/Chief Eng + Bsc + GS + PR	8

**

GS certain credits in research institute

PE Professional Engineer License

PR Public Relation (Profesional research activities)

Table 12.2 THE COMPOSITION OF THE TEACHING STAFF AT AMTA

ACADAMIC DEGREE	TOTAL	DR	MSC/ MA	BSC/ BA	DIPLOMA
CERTIFICATE					
TOTAL	108	25	32	34	10
EX MASTER	9			2	1
MASTER	27	1	5	14	6
EX CH.ENG.	3			3	
CHIEF ENG.	13		3	9	1
MARINE ENG.	2				2
1ST CLASS	1				1
RADIO OFFICER					

CHAPTER 13

BETTER UTILIZATION OF THE EQUIPMENT/ FACILITIES AND IMPROVEMENT OF HEALTHY ENVIRONMENT

I. BETTER UTILIZATION OF THE TECHING EQUIPMENT AND FACILITIES

Generally speaking, China's MET academies are well equipped and more investments are made each year. However, the value of a piece of equipment is not measured by how much one has paid for it but by how much one can make out of it. The effective utilization of this equipment depends very much on the quality of faculty, their understanding of the equipment (- its potential and limitation, and its functions in relation to the larger system) and their desire and ability to exploit all its possibilities. In this respect two factors are essential:

Firstly, adequate attention and sufficient investment should be made in the training and retraining of the faculty concerned in both theory and practice, especially shipboard experience, without which the lecturer will be but an "armchair strategist" engaged in idle theorizing. The training-job gap will be widened instead of being narrowed, particularly when new technology and equipment are involved.

Secondly, the full understanding and support from the administrative and management side should always be available to give the faculty members motivation and opportunity to make better use of the equipment. We must bear in mind that the cost effectiveness of investment on equipment lies in the full utilization of it.

Taking the marine simulator as an example, the utilization depends largely on how many exercises can be developed within its numerous possibilities; how often it is used to train how many students and how many activities it is engaged in other than training. Well designed and organized exercises can gain better results in shorter periods. Multi-engagements actualize the real value of a simulator/simulator system. At MARIN, the Maritime Research Institute in the Netherlands, the ship handling simulator system is used not only in regular training of ship officers, pilots, VTS operators but also in research work concerning work-load, ergonomics studies, communication procedures, casualty investigation, voyage manning scale simulation, remote piloting, traffic planning, etc. Even in the radar simulator training the programs/training scenarios are so designed and automatically controlled that 3 ship's officers and 4 VTS operators are trained simultaneously in separate cubicles of "own ships" and "VTS control stations" with one instructor exercising instructing, monitoring and control. In the exercise, each ship is a target ship to the others and is going in/out of the Harbour under the guidance of a VTS operator.

All the marine simulator systems in China's MET academies have the same or larger capacity and more possibilities, especially the large scale navigation, manoeuvring and radar simulator system newly set up in Qingdao academy which co-functions with

and complements the engine-room simulator, automation engine-room, goto-planetarium and computer center. Its great potential imposes new challenges to the MET staff and the academy management.

Another approach that can contribute to a better utilization of the equipment is to open it to the society, and to related industry so as to get more training missions, co-operation and research tasks. Needless to say this is an approach that will lead to multi-fold benefit. The obstacle lies in the traditional concept of self-confinement in each small "kingdom" which has led to tremendous waste of resources and duplication in investment. It is high time that the whole society realized the problem and started to change such concepts so as to benefit from a co-operative world. This is essential for the country's economic and social development.

II. SETTING UP REGIONAL MARITIME SAFETY TRAINING CENTER

Compared with the developed countries and professional MET training equipment and installment in China's MET academies, maritime safety and pollution prevention training facilities have been a weak sector. There are more than one small basic training center scattered in each seaport city. On this basis, regional full-mission training centers should be set up. Co-invested by shipping industry and MET academies under the coordination of the Ministry of Communications. These should be combined to make better use of the available resources. According to the international experience, each center would mean the investment of millions of dollars. However, considering China's reality and possibility, the same thing can be done with much less money if carefully planned and organized. The short-term and long term pay back can be actualized through the constant large training demands and improvement in maritime safety and marine environment protection contributed to by higher quality seafarers.

III. TRAINING VESSELS

Due to the large shipboard training needs, the present training vessels run by China's MET academies can only cover the basic introductory sea training for students and young lecturers in all the sea related specialities. The newly introduced pre-committed assignment system has made it possible for the graduates to have their compulsory guided sea training on board ships that belong to the companies where they may be recruited upon graduation. This approach has been preferred and used by many countries, but is becoming less applicable due to the campaign for manning cost cutting. In the case of China, it is just the contrary. The pre-commitment is beneficial to both the future employers and employees as well as the academies. Nevertheless, to get the expected training results the following must be well organized, regulated and complied with:

- the co-operation and co-planning of shipping companies and academies for detailed training requirements and arrangements
- Trainee's Work Book and Check List compiled and updated
- shipboard mentors appointed, his commitment and accountability

- recording keeping and report making
- shipboard evaluation
- academy's revision and approval of the sea-training report
- make-up sea-service arrangement in case of trainee's failure in certain operational items

Sail training vessel

In addition to the popular sea practice on board machine-driven training vessels and merchant ships, it should be sincerely considered to invest in one or two sail training vessels, and run them for all the seafaring trainees if financially possible.

Sail training vessel is not just some luxury or something nice to have as many people believe. Its attributes to the enhancement of seafarers' qualities is self-evident. See Chapter 4-I-D-(I).

IV. HEALTHY ENVIRONMENT

The learning environment constitutes an essential element in the education/training process. An Healthy environment contributes directly to the quality of education as well as to the quality and outlook of the students. In the absence of favourable environmental conditions what has in fact been learned often cannot be applied in practice. the interactive nature of the environmental elements is obvious if we consider

- concern shown by the Governmental and society
- academic and professional acceptance
- career expectation and possible further development
- MET institutions' academic and social reputation
- school life and activities
- study and living conditions
- uniform and disciplines

To make a student proud of what he is studying and what he will be engaged in is not simply a matter of persuasion and propaganda. Sincere and concrete efforts must be made in every respect.

For example, in AMTA, Egypt, Monthly Parade is a part of leadership training; the students' affairs' supervisor is responsible for inculcating in students a sense of responsibility, fellowship, and discipline, which develops in them certain leadership traits for their professional careers at sea.

In the USSR, each maritime student is entitled to 6 sets of uniforms for different seasons and occasions. Senior students exercise main gate guard duty in turn.

In Poland, the sail training vessel S.Y. "DARMLODZIEZY"- "The Gift of Youth" carries out one round-the-world voyage every year offering the cadets the opportunity to become acquainted with the seas and the world.

In Denmark, some primary schools set up pen-friends relationship with their national merchant ships. Small pupils show their sincere concern for the ships and their big brothers work and life on board and follow the trading voyages on map. Knowledge

about, interests in and links with the sea, shipping, and the world are gradually planted into the young hearts.

Are these examples too small and insignificant to contribute to a healthy environment favourable to a maritime career or are they too detailed to be considered when formulating a rational MET policy?

CHAPTER 14

SUMMARY AND CONCLUSION

I. BACKGROUND

The world's industry and trading structures have undergone great changes in the last two decades and such changes will undoubtedly continue in the coming decade. In particular the effect of technology transfer and information flow has had a considerable impact on world trade volume and trading patterns. The continuing development of multinationalism and multi-modal transportation is likely to result in a less proportional growth rate in seaborne trade compared with the growth rate of the total world trade volume.

Shipping and shipbuilding industries have experienced severe cyclical and structural crises for years with no end in sight. If anything, competition is escalating all the time. Meantime, development of ship technology and operation, especially in the field of containerization, increased TEU capacity, advanced technology, communications and computerization of documents have all combined with increased speed and lower turn-round time to reduce the number of ship required.

An international frame-work of codes and conventions has been developed within the United Nations specialized agencies. Their implementation sets up standards and guidelines that must be followed worldwide.

The 1990s will see fewer number of but more technology-advanced ships trading more efficiently across the oceans. The requirement for more highly qualified seafarers is increasing. Higher standards of performance are demanded in the perspective of a viable future. The cost-effectiveness concern of all shipping sectors will inevitably drive more and more ships to all forms of international open registries for obvious cost advantages such as low taxes and lower manning costs by using the international seafarers market.

In contrast to other parts of the world, China remains one of the few areas offering the prospect of significant trade growth in the short to medium term and even in the long run. Thanks to the open-door policy in social and economic development, China will continue to be a rapid expanding market in all sectors in the 1990s, generating a great demand for foreign trade. However, the seaborne trade volume will not grow at a parallel rate with the trading value involved. The increasing efficiency and productivity of the nation's ocean-going fleet will not necessitate the same rapid expansion of the fleet size in the next ten years as has happened in the last ten years. Instead, the fleet modernization and renewal hand in hand with the management/operation rationalization have become the first priority for short and medium term development.

All sectors of the current world are striving for optimization and efficiency. Technology, information and management are

lubricating oil for economic development, which depends greatly, if not totally, on the collective manpower quality of a nation. A strategy that combines manpower development, performance improvement and organization development is being developed in China. Effective training and education is integrated with other strategic objectives and together will lead to manpower development, organization development and performance improvement.

II. NEEDS AND POSSIBILITIES FOR A RATIONAL MET POLICY

The chief objective of education and training is to prepare both the brains and the hands for the future and to enhance a nation's quality in the long run. The future belongs to the fittest and the most efficient. It is therefore a matter of vital concern to prepare the right number of people with right qualification at right time.

China's maritime education and training has attained great development and improvement since 1980, yet there is still much room for further rationalization. This is necessary because very soon the MET sector is going to confront overcapacity in its seafaring speciality sector if it only concerns itself with domestic demands. However, on the other hand, the MET sector, as well as all other education sectors of the country, is obliged to exploit and utilize its potential to the fullest due to the fact that the 1990s is the peak period demands for higher/vocational education and employment - 13 million every year.

Firmly anchored to the general education of the country, the quality/calibre of China's MET intakes is among the best in the present world. There will be no excuse for not producing the best quality seafarers through well designed and conducted MET programs.

In order to keep making a continuous positive contribution to the country's development and to the enhancement of safe and efficient ship operation as well as marine environment protection both nationally and internationally, rational steps can be taken from the country's MET policy point of view. Valuable experience and lessons of MET practice around the world and its developing trends must be taken into sincere consideration.

1. To optimize the total MET structure and introduce more flexibility and market adaptability while maintaining necessary stability.
2. To co-operate with the national policy of "contracting more construction projects and labour services abroad" by training for external demands in addition to the internal needs. It will turn out to be a four-fold beneficial engagement.
3. To start a 5-year Dual-purpose ship's officer MET program as a developmental experiment project. The objective is not manning reduction as with the rest of the world but to contribute to a better shipboard team performance and to prepare future senior management personnel.

4. For quality control, on the basis of quality requirements common to all future seafarers different emphasis is to be given on different MET programs according to the specified objectives.

IMO/STCW Convention has specified only the minimum standards/requirements for seafarers based on the shipboard technology and operation level 10 years ago. The MET objectives and standards should therefore not only be confined within this scope, but more should be done in line with the development of technology and shipping practice. The world is changing to higher technology and becoming more interdependent while the sea never changes. The essence of the STCW Convention therefore can be understood as to train and retrain the seafarers so as to keep them qualified for their professional performance.

Particular attention and due efforts should be made with regard to improving the English communications skills of the future Chinese seafarers.

5. To develop and conduct more upgrading/updating and specialized courses as an important means of quality control and enhancement.
6. To make more efforts and investments on teaching faculty optimization as a prerequisite of MET quality enhancement.
7. To improve effective utilization of all the teaching/training equipment and facilities.
8. To attain a healthy environment in all respects to make sure all efforts get the expected results.

Apart from all the above, there are many other factors demanding serious consideration from now on. To mention but two of them:

- a) For the efficiency and effectiveness of the academy management and administration, a breakthrough is badly needed. The Chinese are used to the "unit kingdom" way of running an institution. Everything, from students/staff accommodations to kindergarten and shops are under its domine. Everything is a priority and scatters the managerial/administrative attention from its profession and drains away the limited resources. It seems convenient but actually inefficient and uneconomical from the whole social development point of view. The increase of overall efficiency and productivity lies in specialization and co-operation of the whole society. The modern world is characterised in such a way. The rationalization of social structure has taken place in all developed countries. China needs to do the same.
- b) The eventual increase in living standards as a result of economic and social development and the reduction of port time may influence fewer young people to choose seafaring as their life-career. This has happened in all the traditional maritime countries including Japan and it now is the turn of the NICs - the newly industrialized countries. Before the

turn of the century, China will have to face the same situation, especially when the new generation of "single child of the family" grows up. (China started her "one family one child" birth control policy since 1980. Few families will accept that their single child should go to sea no matter what benefits he can get from it.) The drop in intake may quite likely start around 1995. Such an unfavourable situation will arise independent of man's will. As a supply side, the MET sector can do little about it, even the shipping sector, but they must get themselves prepared and make necessary pre-adjustment both in policy and in practice, especially when long term project investment is concerned.

In conclusion, it is all a matter of perceptions, that one of these things that in the short term may mean very little but in the long term may mean everything. In most cases, opportunity knocks but once.

However, neither shipping nor MET is the end. They are both means to achieve the end. They are both subsystems of a bigger system, and indispensable links of the total chain. They are interacting with each other; influencing the other sectors and being influenced at the same time. Therefore it is important for a big country like China to try all means to optimize each subsystem and to provide the possibility for an optimal total system so as to make $2 + 2$ more than 4.

ANNEX 1 LIST OF THE MAJOR PIPEINE PROJECTS

- a) Crude oil pipelines from the Saudi Arabean Gulf coast through Iraq, Lebanon to the Mediterranean coasts;
- b) Crude oil pipeline between the Saudi Arabean Gulf coast and the Red Sea coast port Yanbu;
- c) Natural gas pipelines from Quan Taradert, Algeria, through Tunisia to Italy;
- d) Natural gas pipeline from Quan Taredert to Onahran, then to Spain (under construction);
- e) Pipelines from North Sea oil fields to UK, Scandinavian countries and continantal European countries;
- f) Oil pipeline from North Slope of Alaska to Valdez, USA and then, links the USWC to USEC by super tankers via Panama Pipeline near the Panama Canal;
- g) Oil pipeline from USSR to continantal European countries (under construction).

Etc.

A P P E N D I X 2

SOME RESEARCH WORK ON MAN-MACHINE RELATIONSHIP (THE NETHERLANDS)

Nowadays, ships are becoming larger, faster, more technologically advanced and manned with smaller crews while the waterways are becoming more crowded. Modern ship itself is becoming a quite complicated man-machine system and makes ergonomic studies more important for both safety and efficiency in ship operation.

ERGONOMICS is to use the study result of task difficulty, working load (mental and physical), environmental factors, psychological measurements, etc. to design products, tools, working environment and working methods in such a way that highest degree of safety, efficiency and comfort is attained for the operation and maintenance of the man-machine system.

1. MARIN, the Maritime Research Institute of the Netherlands, has for years focused its studies on optimization of the relation between man and technology. Topics such as:
 - implications of automation onboard
 - layout of future bridges
 - socio-technical analysis of shipping systems
 - shipboard management
 - reduction of maintenance and repair
 - rationalization experiments onboard
 - efficiency improvement, etc.are well covered and meant to improve the insight in their impact on MET and on the co-operation between governments, shipowners and unions with respect to rationalization. One of the aims has been to find out how all parties involved may agree with new procedures enabling the operation of ships with lower manning level. Further analysis has been made concerning the corresponding requirements for MET as a consequence of the rationalization of shipboard organization.

Recent in-house study is on "work load" in order to determine the demand of human input (discipline and knowledge level subject to the applied technology onboard and to trade routes of the ship).

2. Another similar project is carried out MARIN and other Dutch research institutions to develop a man/machine model of the man/ship system.

This model consists of two submodels:

- the mathematical model of the human operator (navigator)
- the mathematical model of the ship dynamics

The model of the human operator is based on on the principle of the Human Perception Cycle, i.e. perception--processing--decision--action--. According to the principle:

- This cycle applies to man in amenable situations as well as under heavy physical and/or mental stress.
- a knowledge of mental and physical capacities of man is essential to allow tasks and working environments to be adapted to fit these constraints.

- Only by following such a procedure can a task be fulfilled efficiently and material be exploited to the fullest.
- 3. The same has also been extensively used as an initial point for the studies done by IFP(Institute for Perception) experts on the project of One man navigation task and the appropriate new bridge design and layout.
 - a) the task of finding the optimal manoeuvre (mental task)
 - b) the load imposed by the mental task
 - Function allocation
 - work station design - an efficient and comfortable working location
 - environment
 - job design - optimal allocation of tasks between man and machine
 - task structure (* Badly structured tasks may lead to:
 - complaints and less efficiency
 - unnecessary errors and failures
 - an increasing sick-absenteeism
 - manning estimation
 - selection and training.

A P P E N D I X 3

VESSEL TRAFFIC SERVICE/MANAGEMENT SYSTEM

1. GENERAL FORMATION OF A VTS SYSTEM

In general, the system consists of 3 major parts:

a) Information sources

- Radar surveillance network
adequate number of radars to provide a full or double coverage (the important areas) to the whole traffic areas. In the case of Port of Rotterdam, 23 and Port of Gothenburg, 3, each with its own tracker to fix the position
- Radio direction finders (RDF)
to pick up ship's report automatically, transfer it to the DHS to be processed and shown as the bearing lines on the display
- Hydrometeor sensors
for measurements of visibility, winds and water levels
- Voice communication recorded
- Integrated communication system
* VHF * mobile phone * radio

b) Data Processing

All the raw data/information will be transferred to the Data Handling System (DHS), the real heart of VTS, for processing. It will combine all the information into one single traffic picture and display in either/both raw and/or computerised form/s, thus providing a visible view of a traceable and predictable traffic situation.

c) Harbour Coordinate Center and On-scene Traffic Control Station

- coordinate and control the traffic

2. Functions of VTS system

- navigational advice, information or operational assistance to ships
- protection of vessels carrying hazardous cargoes
- a continuous automatic monitoring service for all vessels in the port or its approaches
- protection of offshore or underwater installations
- monitoring separation zones or shipping lanes
- compliance with safety regulations
- assistance to Search and Rescue or emergency services
- Traffic and Port Administration System
- possibility for remote piloting
- possibility to predict congestions of given points in the port and enable a better allocation of harbour resources, e.g. pilots, tugs and hawsermen, etc.

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