BASIC DESIGN STUDY REPORT

ON

THE PROJECT

FOR

UPGRADING PAKISTAN MARINE ACADEMY

IN

THE ISLAMIC REPUBLIC OF PAKISTAN

MARCH 1987

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

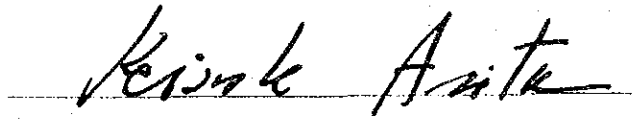
In response to the request of the Government of the Islamic Republic of Pakistan, the Goverment of Japan has decided to conduct a basic design study on the Project for Upgrading Pakistan Marine Academy and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to Pakistan a study team headed by Capt. Yutaka Tanabe, Chairman of the Department of Navigation, Institute for Sea Training, Ministry of Transport, from December 2 to 18, 1986.

The team had discussions on the Project with the officials concerned of the Government of Pakistan and conducted a field survey in Karachi area. After the team returned to Japan, further studies were made and the present report has been prepared.

I hope that this report will serve for the development of the project and contribute to the promotion of friendly relations between our two countries.

I wish to express my deep appreciation to the officials concerned of the Government of the Islamic Republic of Pakistan for their close cooperation extended to the team.

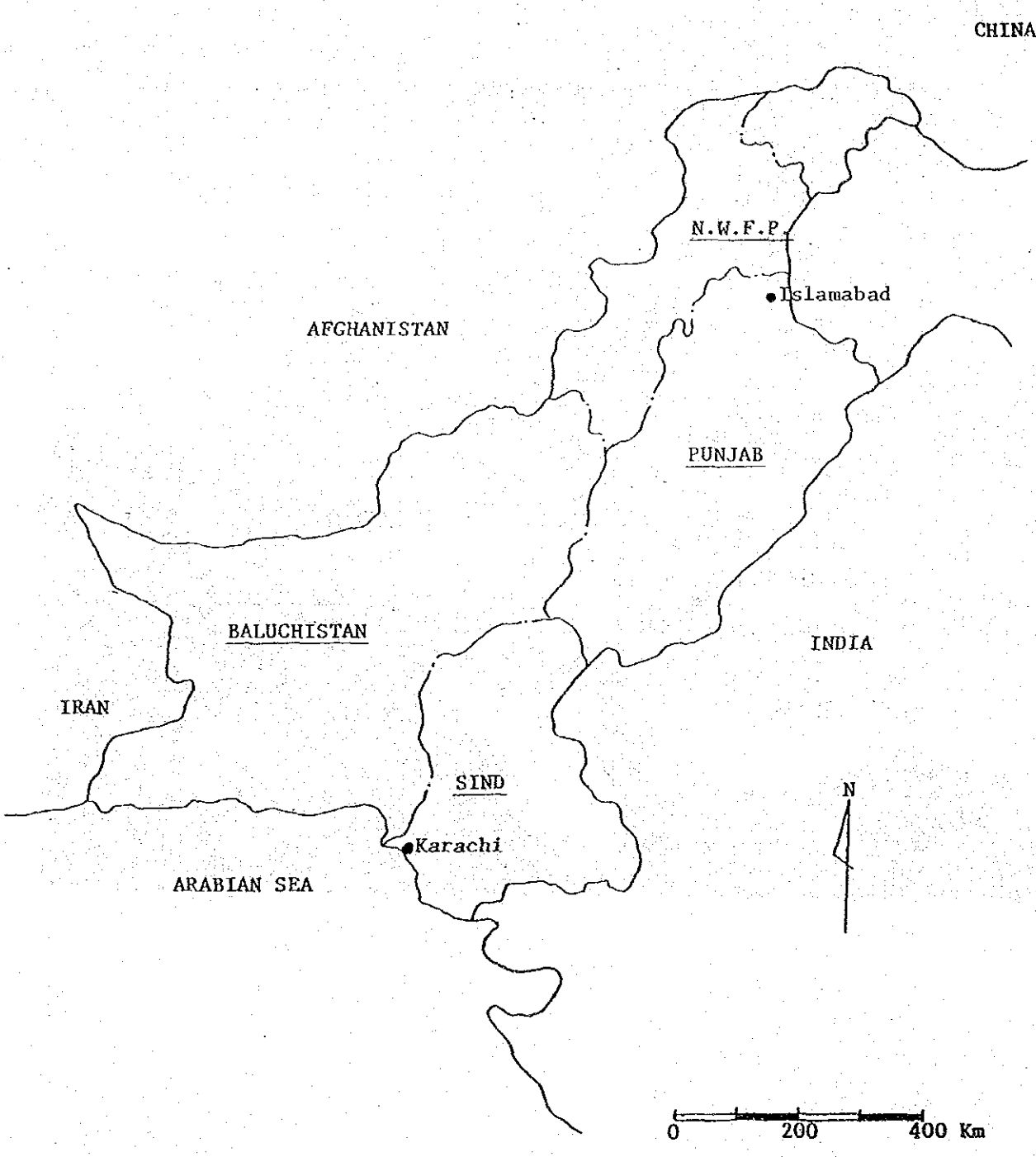
March, 1987



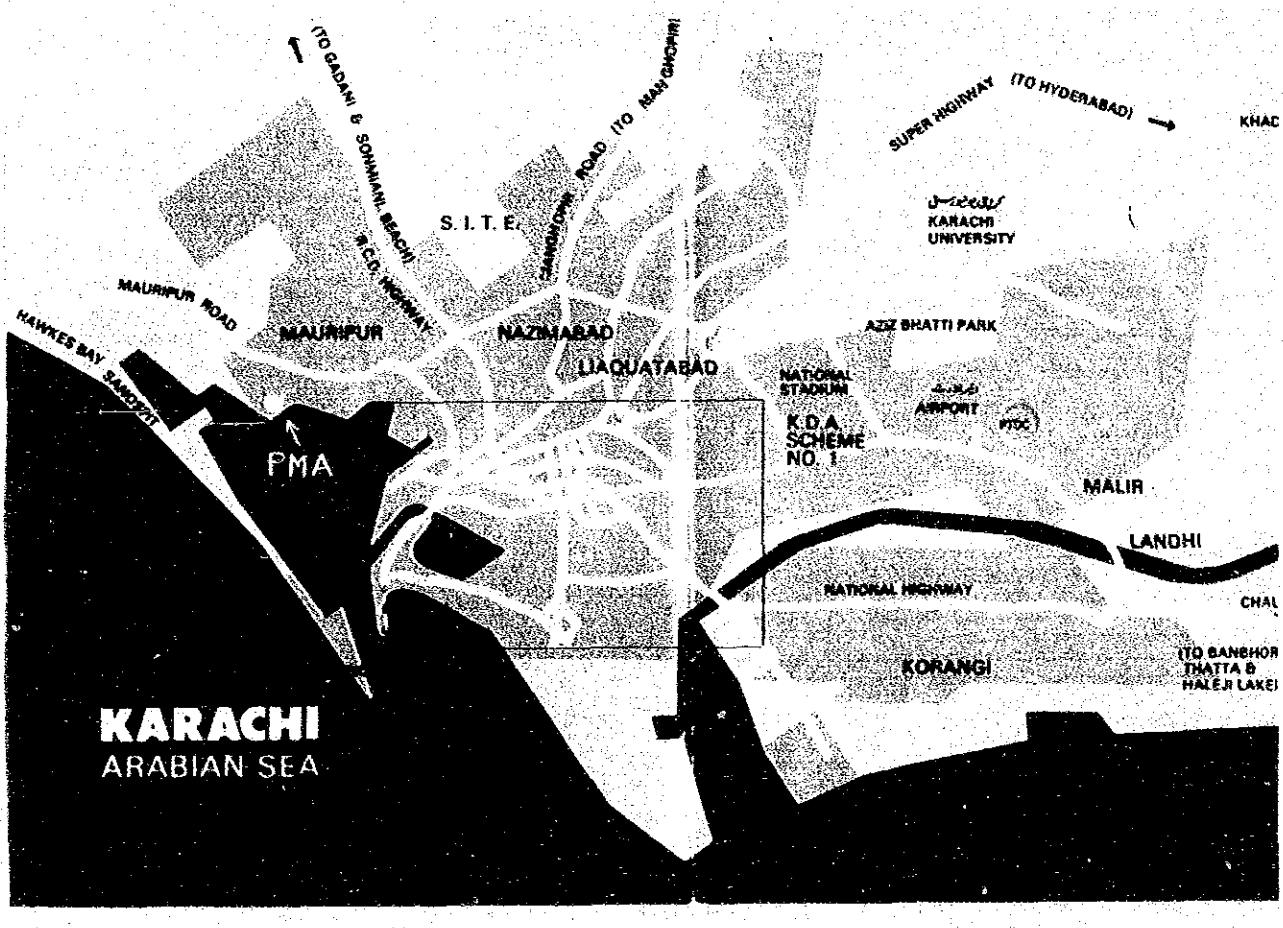
Keisuke Arita

President
Japan International Cooperation Agency

MAP OF PAKISTAN



MAP OF KARACHI



SUMMARY

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The Islamic Republic of Pakistan (hereinafter called Pakistan) now has 38 vessels, including 3 Pilgrim ships, with total dead weight of approximately 550,000 tons. There are around 14,000 registered seamen.

Due to geographical conditions all cargo is carried by ocean-going vessels and the annual growth rate of cargo flow is at present 5%.

To cope with the increase of cargo handling, a new expansion program for port facilities in Karachi and Qasim is now proceeding.

The administration of maritime industries is under the control of the Ministry of Communications and this ministry is aiming to promote the national shipping fleet through participation of private business activities in this sector.

The new fleet expansion program aiming at fleet renovation consists of 15 new vessels to be built during 5 years from 1983 to 1988.

Due to a recent trend towards the advancement of navigational technologies and ever increasing interest in the safe navigation at sea, the International Maritime Organization (IMO) has adopted STCW convention (International Convention on Standards of Training, Certification and Watchkeeping for Seafarers) for the purpose of upgrading the quality level of seamen from every country.

Pakistan Marine Academy (PMA) is the only seamen training institution under the jurisdiction of the Ministry of Communications and is playing an important role in this field.

And under such circumstances, the academy has been conducting the following training:

a) Pre-sea training for nautical and engineering cadets,
b) Post-sea training for higher qualification intended for already qualified seamen, and

c) Specific training to satisfy requirements of STCW convention, etc.

In addition to these, PMA plans to offer new training which enables the applicants to obtain the highest grade qualification (equivalent to British Class I) in Pakistan. This cannot be done at present due to insufficient training equipment.

It is under such circumstances that Pakistan requested Japan to provide the necessary equipment under Japan's Grant Aid Program.

In response, Japan has decided to conduct a preliminary study through the Japan International Cooperation Agency (JICA) to confirm the contents and priority of the equipment request. The team conducted the study in July and exchanged and signed "MINUTES OF DISCUSSIONS" with the Pakistani officials in charge.

Subsequently, the basic design study team carried out their study work from December 2nd to 18th in Pakistan for the investigation of the detailed content and scale of the project through field survey and discussions with the government and PMA officials concerned, at Karachi and Islamabad.

The outline of the findings of the study is as follows:

1. Confirmation of PMA's attitude toward upgrading the seamen's navigational technology, inclusive of satisfying STCW convention requirements and the necessity of the establishment of a new educational program.

2. PMA's buildings and halls are already in fully available condition for the installation of the requested equipment.
   With the aid of requested equipment, PMA will be able to conduct training for even the highest class seamen qualification in Pakistan and will not have to send the applicants to U.K. etc. for this purpose.

3. Considering the present large number of PMA's applicants and the high competitive ratio at the entrance examination, cadets are considered

capable of getting higher level education. But unfortunately, due to a lack of some key equipment, such excellent cadets find it difficult to develop their own ability to the fullest extent. This means a loss to Pakistan's human resources development and in order to overcome such a situation, the implementation of the equipment supply along with technical cooperation is considered to be urgent.

The following items have been selected by the basic design study team as the most suitable for the project in terms of the careful analysis of Pakistan's present fleet activities and the requirement of STCW convension. Also a new training curriculum is recommended to correspond with the availability of the equipment.

1)	Radar simulator	1 set
2)	Celestial navigation	1 set
3)	Compass	1 set
4)	Life raft	1 set
5)	Model of typical ship	1 set
6)	Loading calculator	1 set
7)	Model of cargo gear	1 set
8)	Cut away model	1 set
9)	Various types of valves	1 set
10)	Testing and measuring equipment	1 set
11)	Workshop machine	1 set
12)	VHF radio telephone	1 set
13)	Ship maneuvering simulator	1 set
14)	Engine plant simulator	1 set

The equipment provided under this project can all be installed in the present building and no new buildings are necessary for this purpose.

Local transport, setting, wiring inside the intended room space, mechanical adjustment and test operation running for the requested equipment are taken care of by the Japanese side.

All necessary electric sources, illumination, tables and desks, furniture, etc. for educational purposes are arranged by the Pakistan side. Necessary expenditure for the Pakistani side is estimated at 10,625 Rupees.

The following time periods after the exchange of notes are signed on: 3.5 months for detailed design preparation, 2 months for tendering procedure, 12.5 months for equipment manufacturing, 1.5 month for transport, 4.5 months for installation and fitting job. A total period of 23½ months is estimated except duplicated work period.

PMA is responsible for the maintenance and operation of equipment and annual expenses are roughly estimated at 670,000 Rupees. With the financial support of Port and Shipping Wing, the amount is considered attainable.

As to the maintenance and operational system, the following items should be borne in mind.

(1) Maintenance and Operation Manual to be prepared.
(2) Appointment of responsible personnel for this purpose.
(3) Necessary budgetary arrangement should be made.
(4) Technical training for the responsible personnel.

For the sake of using the equipment effectively, performance capability and function must be fully studied. Accordingly, (1) Responsible personnel's training in Japan and (2) Japanese experts' technical guidance at PMA are considered necessary.

Finally, after such programs are implemented as planned, the social benefits resulting from this project are:

(1) Improvement of technical level of Pakistani seamen
(2) Expansion of the scope of seamen training in terms of knowledge and skill
(3) Greater development of Pakistani shipping industry.

Thus the grant aid for this project can be evaluated as having the highest significance.

CONTENTS

CHAPTER 1 INTRODUCTION

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All maritime transportation of cargo in the Islamic Republic of Pakistan is done by her ocean going fleet, because the country has no appreciable domestic cargo flow at present. The Ministry of Communications, which is the government office with jurisdiction over marine transportation, is now encouraging the participation of the private enterprises in this sector to reinforce Pakistan's commercial fleet activities. At present, the International Maritime Organization (IMO) is asking maritime countries all over the world to upgrade the quality of their seamen through the "International Convention on Standards of Training Certification and Watchkeeping for Seafarers, 1978" (hereinafter referred to as "STCW convention"). The objective is to promote safety of life and property at sea and to protect the marine environment in view of the growing international interest in the renovation of navigation techniques and on board safety measures.

At present, the Pakistan Marine Academy (hereinafter referred to as PMA), also under the jurisdiction of the Ministry of Communications, is the nation's only institution for training seamen. The Government of Pakistan is working out a plan to train new nautical officers and engineers. The government also plans to provide necessary training for the qualification of seamen required by international conventions. Moreover, the said plan also includes the training of the highest-class seamen (Class I of the British Qualification Standards) at PMA. The training presently occurs only in foreign institutions. Accordingly, the Government of Pakistan has requested the Government of Japan to provide a grant aid for the supply of training/educational equipment and materials necessary to carry out the said plan.

In response to the request, the Government of Japan decided to conduct a preliminary survey to analyse the background and contents of the request in order to further understand this plan. The preliminary survey was con-

ducted through the Japan International Cooperation Agency (hereinafter referred to as JICA) from 28th July to 7th August 1986.

Subsequently, JICA sent the "Basic Design Study Team", headed by Capt. YUTAKA TANABE, Chairman of the Department of Navigation Institute for Sea Training, Ministry of Transport, to Pakistan from 2nd to 18th December 1986 with the objective of conducting the studies as required.

The team had a series of discussions on the project with the concerned officials of the Government of the Islamic Republic of Pakistan and conducted a field survey in the Karachi area, and the minutes of discussions were exchanged between Capt. TANABE and Mr. SAJJAD AKBAR, Additional Secretary/Director General, Ports & Shipping Wing, Ministry of Communications. (Refer to the Appendix-1). The report refers to the field survey, the results of the discussions held with concerned officials of the Government of Pakistan and data and materials collected in Pakistan. The report also states the basic design, the implementation and operation & maintenance plans, and the project evaluation and finally conclusions and recommendations.

CHAPTER 2 BACKGROUND OF THE PROJECT

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2.1 Socio-economic Conditions of the Country

- Population

Pakistan borders many countries, such as Iran, Afghanistan, China and India, and its southern coast faces the Arabian Sea.

Land area being 796,096 square kilometers, Pakistan is approximately 2.2 times as large as Japan.

The population reportedly reached 93.3 million in mid-1984, and the demographic growth rate averaged 3.1% from 1982 to 1985.

- Climate

The climate of Pakistan is not uniform, as it varies with terrain and location, but generally speaking the summer extends from April to June and from September to October. July and August are the Monsoon season and winter lasts from November to March.

As for the climate of Karachi, where PMA is located, the winter temperature ranges from 5 to 25 degrees Centigrade and the summer temperature from 23 to 43 degrees Centigrade. Humidity ranges from 44% to 64% in winter and from 70% to 95% in summer. The annual rainfall is barely 240 mm. The ground is dry, and at rare intervals, there are strong sandstorms.

- Economy

The VI Five-year Development Plan, now being implemented, was initiated in July 1983. The plan's total expenditures amount to 495 billion Rupees, of which the government sector accounts for 295 billion Rupees, or 60%, and the private sector for 200 billion Rupees, or 40%.

The targets and priorities of this development plan are as follows:

(1) Annual GDP growth rate of 6.5% (with expectations of agricultural production, particularly small-scale farmers), thereby increasing household income by 20%.

(2) Development of public services

(3) Encouragement of cooperation between the public and private sectors

(4) Priority given to public enterprises in the formation of capital

(5) Decentralization of development to all provinces

(6) Strengthening the functions of local administrative units

(7) Creation of 4 million new employment opportunities

(8) Development of rural areas

(9) Improvement of the social status of women

(10) Welfare for the handicapped, etc.

The evolution of investments in various fields of Pakistan's public sector is shown in Table 2.1.1. The energy field accounts for the largest proportion, 38.2%. Next comes the transportation and communication, which accounts for 18.9% of the expenditures.

Table 2.1.1 Development of Investments in Various Fields of the Public Sector

(Million Rupees)

Sector	First plan (1955-60)	Second plan (1960-65)	Third plan (1965-70)	Non plan period (1970-78)	Fifth plan (1978-83)	Sixth plan allocations (1983-88)
1. Agriculture	461	902	1377	6492	14860	15350
(a) Agriculture	461	695	822	4141	6060	12350
(b) Fertilizer subsidy	-	207	555	2351	8800	2000
2. Water	969	4597	4513	12810	15770	32100
3. Energy	607	1293	1760	13841	38830	116500
(a) Power	575	1165	1571	10880	28119	87400
(b) Fuels	32	128	189	2961	10597	27500
(c) Renewables energy	-	-	-	-	114	1600
4. Industry	742	478	786	11294	25400	20500
5. Minerals	124	94	271	492	400	5750
6. Transport and communications	1080	1595	2521	15653	35210	57520
7. Physical planning and housing	505	957	698	5687	9000	15500
8. Education and manpower	232	463	563	3442	5640	19850
9. Health	76	174	281	2381	4580	13000
10. Population welfare programme	-	9	145	820	600	2300
11. Others/misc. programmes	67	44	289	2632	2320	6630
Total	4863	10606	13204	75544	152610	305000

(Source: Planning Commission)

2.2 Present State of Merchant Shipping in Pakistan

2.2.1 Present cargo flow

Cargo flow (consisting entirely of ocean shipping), including imports and exports, amounted to 14.91 million tons in fiscal 1980/81; 16.37 million tons in fiscal 1981/82; 16.19 million tons in fiscal 1982/83; 17.64 million tons in fiscal 1983/84; and 17.90 million tons in fiscal 1984/85. The annual growth rate averaged approximately 5%. Imported commodities totalled 14.54 million tons in fiscal 1984/85, with 6.5 million tons of petroleum, 1.19 million tons of iron ore, 1.07 million tons of wheat, 760,000 tons of edible oil, 720,000 tons of cement, 590,000 tons of iron and steel, and 570,000 tons of fertilizers. Exported commodities totalled 3.36 million tons in fiscal 1984/85, consisting mainly of 730,000 tons of rice, 670,000 tons of molasses, 370,000 tons of fertilizer, 290,000 tons of petrochemical products and 100,000 tons of cotton.

The transportation of pilgrims is being carried out between Karachi and Jeddah by means of regular pilgrim vessels.

2.2.2 The merchant fleet and marine transportation activities

In 1971 Pakistan had a merchant fleet consisting of approximately 70 vessels, but many ships were lost on the occasion of the separation of East Pakistan (currently Bangladesh).

The nationalization policy was implemented after that, with the expropriation of private shipping companies, and in 1979 the two existing shipping companies were unified to form the Pakistan National Shipping Corporation (hereinafter referred to as PNSC) with the objective of strengthening the national shipping industry. PNSC promoted the expansion and replacement of aged vessels with the construction of 7 multi-purpose 18,000 DWT type cargo ships from 1980 to 1981. Financial resources were provided by yen credit loans

from Japan (18 billion yen). And now, PNSC has a fleet of 33 ships, consisting mainly of conventional ships and new multi-purpose cargo ships. Besides PNSC, the Pan Islamic Steamship Co., Ltd. (hereinafter referred to as PISC) has 3 pilgrim ships and 2 cargo ships. The breakdown of the fleets of these navigation companies is shown in Table 2.2.1.

Table 2.2.1 Fleets of Navigation Companies of Pakistan

S. No.	Ship name	Year of construction	D.W.T.	Speed (knots)
1.	m.v. Islamabad	1983	18,204	16.5
2.	m.v. Sibi	1981	16,469	16.5
3.	m.v. Khairpur	1981	16,469	16.5
4.	m.v. Nawabshah	1981	16,469	16.5
5.	m.v. Ayubia	1981	18,050	16.5
6.	m.v. Kaghan	1981	18,050	16.5
7.	m.v. Murree	1981	18,050	16.5
8.	m.v. Multan	1980	18,257	16.5
9.	m.v. Bolan	1980	18,144	16.5
10.	m.v. Chitral	1980	18,144	16.5
11.	m.v. Hyderabad	1980	18,257	16.5
12.	m.v. Malakand	1980	18,224	16.5
13.	m.v. Sargodha	1980	18,242	16.5
14.	m.v. Makran	1979	23,490	15.0
15.	m.v. Lalazar	1974	13,539	14.0
16.	m.v. Hunza	1972	15,928	13.0
17.	m.v. Hinglaj	1972	15,928	13.0
18.	m.v. Ocean Envoy	1972	15,215	12.0
19.	m.v. Shalamar	1970	13,391	13.0
20.	m.v. Sunderbans	1968	13,069	13.0
21.	m.v. Moenjodaro	1968	13,069	14.0
22.	m.v. Rangamati	1968	13,069	14.0
23.	m.v. Tarbela	1968	13,330	14.5
24.	m.v. Taxila	1968	13,069	14.0
25.	m.v. Warsak	1968	13,330	14.0
26.	m.v. Kaptai	1968	13,330	14.0
27.	m.v. Ziarat	1968	1,747	9.5
28.	m.v. Ohrmazd	1968	13,277	13.0
29.	m.v. Bagh-e-Dacca	1966	12,875	13.0
30.	m.v. Chenab	1965	12,786	13.5
31.	m.v. Bagh-e-Karachi	1964	12,875	13.0
32.	m.v. Al-Kulsum	1960	14,834	12.5
33.	m.v. Shams	1960	11,300	14.0
1.	m.v. Safina-e-Abid	1951	5,324	15.0
2.	m.v. Safina-e-Arab	1962	6,967	15.0
3.	m.v. Safina-e-Haider	1963	12,838	13.0
4.	m.v. Safina-e-Ismail	1958	11,375	13.0
5.	m.v. Safina-e-Rehmat	1958	12,511	13.0

(Source: PNSC & the Ministry of Communications)

This merchant fleet accounts for the transportation of 19% of imported and exported commodities of Pakistan. However, this percentage falls far behind the desirable loading rate of the UNCTAD which has adopted a standard of 40% (national cargo):40% (partner country's cargo):20% (third country cargo), which Pakistan regards as a target. Thus, the Pakistani authorities expect that there will be room for increasing the loading rate by her own ships. An increase in merchant fleet tonnage is also expected, because the movement of cargo is increasing every year. Consequently, PNSC is drawing up plans to build 15 new vessels in the coming 5 years. The breakdown of the new vessels is as follows:

- Container ships (1,200 TEU capacity)	4 units
- Multi-purpose ships (600 TEU capacity)	5 units
- Bulk cargo ships (50,000 DWT)	4 units
- Edible oil tankers (10,000 DWT)	1 unit
- Petroleum tankers (75,000 DWT)	1 unit

There is a possibility of further expansion in the merchant fleet in addition to the aforementioned vessels, since PISC is drawing up plans to construct two additional cargo-passenger ships (capacity: 1,500 passengers). Moreover, there is a possibility that private companies will participate in this sector as a result of the encouragement being promoted at the present.

2.2.3 Marine transportation policy

The Ports and Shipping Wing of the Ministry of Communications is in charge of marine administration in Pakistan. (See Fig. 2.2.1.)

The shipping business in Pakistan was developed through the nationalization of PNSC in the 1970's but in the 1980's, the decision to allow the participation of private investors in the navigation business was adopted to improve worsening trend of maritime activities of PNSC.

It is also necessary to implement further measures to promote renovation of the fleet to strengthen the competitiveness of the shipping companies of Pakistan. Along these lines, under the auspices of The VI Five-year Development plan, the investment of 3 billion Rupees is being planned.

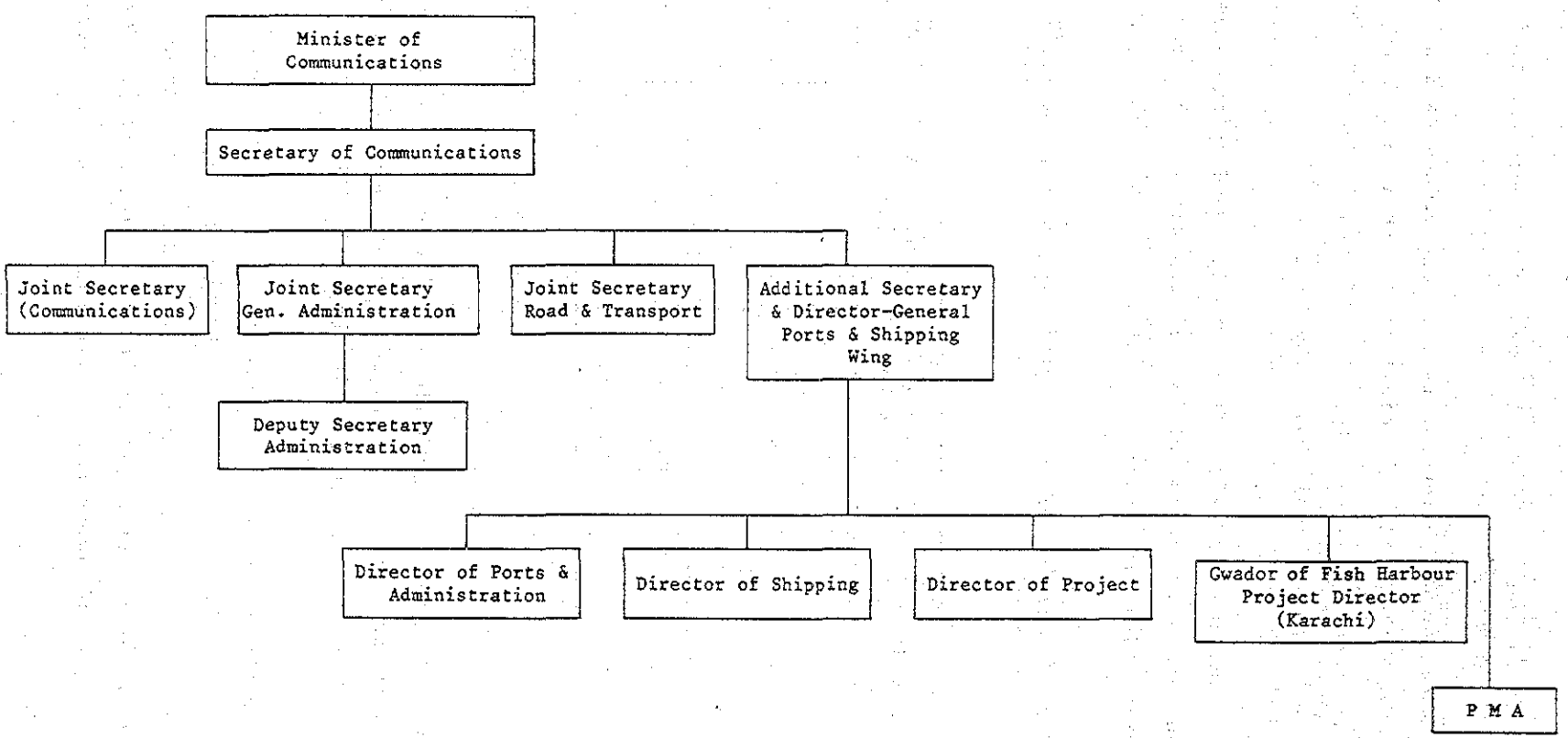


Fig. 2.2.1 Organization of the Ministry of Communications

2.2.4 Present state of the shipbuilding industry and port facilities

The most important establishment is the state-owned Karachi Shipyard & Engineering Works, Ltd. (hereinafter referred to as KSEW), and several small-scale private shipyards and repair shop are building new ships and reparing small boats and barges.

KSEW was established in 1950. It is wholly owned by the government and has an operating capital of 154 million Rupees. The capacities of its shipbuilding and repair facilities are shown in Table 2.2.2.

Table 2.2.2 Capacities of the Shipbuilding Berths and Docks of KSEW

	Berth & dock No.	Length x Width (meters)	Crane capacity (tons)	Maximum ship (DWT)
New ships	1	169 x 23	40	15,000
	2	118 x 24	40	6,000
	3	213 x 31	40	26,000
Repair ships	1	189 x 27	30	26,000
	2	171 x 24	15	18,000

(Source: KSEW)

The maximum capacity for new building and repair for all kinds of vessels is 26,000 DWT, but the biggest vessel built so far, is an 18,000 DWT Multi-Purpose cargo ship (built in 1983).

Two major ports are available for ocean shipping business; Karachi and Qasim. The Karachi port has 28 berths (handling capacity 6 mil. ton general cargo, 12 mil. ton semi-bulk, 8 mil. ton crude oil and 2 mil. tons of general cargo by another expanding berth). The berth occupying ratio was improved from previous (5 - 6 years ago) 125% to 90 - 95% now.

As for future expansions of the both facilities in Karachi, there are plans to substitute 2 old berths with modern liquid cargo berths and to build 2 berths for container terminals.

On the other hand, the Qasim port has 8 berths, of which the steelworks cargo handling berth handles 3.36 million tons of iron ore and coal annually. The 7 remaining berths handle 5 million tons of bulk cargo annually.

As for future expansion of the Qasim port, there are plans to remodel 3 berths for container handling and to build a terminal with the capacity to handle an annual quantity of 3 million tons of petroleum by fiscal 1989/90.

The development of the cargo handling in the Karachi port, is shown in Table 2.2.3.

Table 2.2.3 Development of the Cargo Handling in the Karachi Port

(Unit: 1000 tons)

Year/month	Total cargo handled	Imports			Exports		
		Total	Foreign	Coastal	Total	Foreign	Coastal
1978-79	15,025	11,987	11,987	-	3,038	3,003	35
1979-80	14,657	11,259	11,259	-	3,398	3,379	19
1980-81	14,654	11,037	11,037	-	3,617	3,603	14
1981-82	15,137	11,589	11,589	-	3,548	3,526	22
1982-83	14,788	11,709	11,709	-	3,079	3,057	22
1983-84	14,998	12,445	12,445	-	2,553	2,546	7

(Source: Karachi Port Trust)

2.3 Present State of Pakistani Seamen

2.3.1 Number of seamen

The number of registered seamen is 13,859, and its breakdown is shown in Table 2.3.1.

Table 2.3.1 Number of Pakistani Seamen

	Officers (perons)	Crew (persons)
Personnel onboard	3,253	3,041
Standby personnel for replacement	1,247	3,041
Personnel related to port & shipping duties		3,277
Total	4,500	9,359

(Source: PMA)

The number of Pakistanis in foreign vessels reportedly amounts to approximately 5,000 persons, but there are no accurate data available in this area.

2.3.2 Seamen qualification and registration system

As for the qualification of Pakistani seamen, both mate officers and engineers are classified in categories ranging from Class I to Class IV, and each category requires stipulated experience onboard and/or training at shipyards. Seamen who wish to get certificates in higher categories have to undergo retraining courses at PMA. These programs are planned in accordance with the relevant rules and regulations, and only those who have passed the national examination held by the Ports & Shipping Wing of the Ministry of Communications are granted certificates.

The system of qualifying Pakistani seamen, the Merchant Shipping Act 1923, was based on the British equivalent. The British law, on which the Pakistani act was based, has since been revised in accordance with STCW convention that was ratified by the British. Today, the United Kingdom has its system of seaman qualification based on The Merchant Shipping Regulations 1980. Pakistan is in the process of revising its Merchant Shipping Act according to the revised British equivalent.

2.4 Outline of the Executive Agency (PMA)

2.4.1 Training of seamen

Broadly speaking, the school system in Pakistan consists of: elementary education (elementary school—5 years), first-term secondary education (junior high school—3 years), second-term secondary education (senior high school & junior college—4 years), and higher education (universities & colleges—2 to 6 years).

The school attendance rate is 53% for elementary school, 37.1% for junior high school, and 18% for senior high school.

PMA takes charge of specific training courses, such as the training of new seamen, the re-training of seamen in active service, and other training (survival at sea, fire fighting, first aid, etc.).

2.4.2 Present state of the education & training of seamen

(1) Training courses for cadets

Cadets are selected from those students who achieve good grades in the 12-year school education. They are admitted to PMA after medical examinations. They are assigned either to the nautical course or the engineer course for a 2-year program that consists mainly of theoretical studies in the classroom.

Later, they go on-board or attend workshop training, which lasts approximately 3 years. After retraining at PMA, they are sent to the shipping companies as deck cadets or assistant engineers.

The number of students who participated in training courses for cadets in recent years is shown in Table 2.4.1

Foreign countries' cadets are allowed to attend: Iranian cadets are now attending.

Tale 2.4.1 Status of Students Undergoing Cadet Training

	Applicants		Approved students		Students leaving the academy halfway		Graduates
	Pakistani	Iranian	Pakistani	Iranian	Pakistani	Iranian	
1984	693	50	30	50	9	1	70
1985	1,163	18	34	18	13	3	36
1986	891	3	34	3	2	-	35

(Source: PMA)

The curriculum of the training courses for cadets are outlined below.

(a) Deck & engine cadets (hrs.)

Mathmatics	320
Physics	320 (Experiment in P.M.)
English	288
Pakistan studies	32
Islamic studies	32
Humanities and social science	64

(b) Deck cadets

(i) Navigation

a. Principles of navigation	192
b. Ocean and offshore navigation	160
c. Coastal navigation	128
d. Radar navigagion	96
e. Electronic navigation	64

(ii)	Ship operaton	
	a. Seamanship (Classroom)	192
	b. Seamanship (Laboratory)	64
	c. Watch keeping	64
	d. Marine communication	64
(iii)	Engineering knowledge	32
(iv)	Ship operation	
	a. Ship stability	96
	b. Ship construction	96
	c. Cargo work	128
(v)	Meteorology	64

(c) Engine cadets

(i)	Heat engine	192
(ii)	Mechanics	192
(iii)	Machine drawing	192
(iv)	Electro-technology	128
(v)	General engineering knowledge	128
(vi)	Instrumentation and control system	32
(vii)	I.C.E. Engineering knowledge	96
(viii)	Naval architecture	40
(ix)	Ship construction	24
(x)	Workshop theory	128
(xi)	Workshop practice	288

The above education is conducted with the aid of the academy's available equipment consisting mainly of exhibited dummy models or actual items. Ship position-fixing, ship maneuvering, etc., rely mostly on classroom lectures due to the non-availability of suitable electronical navigational equipment such as radar, loran etc.

(2) Retraining courses

When seamen in active service wish to get higher qualifications, they are admitted to a retraining course lasting about 4 months. After completing the course, they are eligible to take national examinations for higher category qualification certificates.

Retraining after active service on board is carried out in the following steps:

(a) A Class IV Seaman Qualification Certificate after finishing the first training on-board and in a workshop.

(b) From Class IV to Class III Seaman Qualification Certificates.

(c) From Class III to Class II Seaman Qualification Certificates.

These 4-month retraining courses are tailored to the respective examinations. The main subjects taught in these courses are outlined below.

PMA's Retraining results are shown below:

Nautical Dept.

Qualification	Year	No. of trainees
III & IV Class	1985	114
III & IV Class	1986	62
II Class	1985	76
II Class	1986	50

Engineering Dept.

Qualification (1985)	No. of trainees
II Class A	140
II Class B	77

Subject of Retraining curriculum

Nautical Cadets

Class IV

(i) Knowledge of vessels
(ii) Chart operation
(iii) Practical navigation
(iv) Meteorology
(v) Oral examination
(vi) Signal

Class III

(i) Knowledge of vessels
(ii) Chart operation
(iii) Practical navigation
(iv) Meteorology
(v) Oral examination
(vi) Signal

(vii) Applied science
(viii) Mathematics
(ix) Principles of navigation

Class II
(i) Coastal navigation
(ii) Ocean and offshore navigation
(iii) Meteorology
(iv) Various operations on ships
(v) Ship construction and stability
(vi) Actual operation and knowledge
(vii) Oral examination
(viii) Signal

Engine cadets
Class IV
(i) Engineering knowledge (diesel and steam)

Class III
(i) General engineering knowledge
(ii) Engineering knowledge (diesel and steam)

Class II
(i) Mechanics
(ii) Thermodynamics
(iii) Mathematics
(iv) Drafting
(v) Engineering
(vi) Engineering (internal combustion engine)
(vii) Engineering (steam engine)
(viii) Electro-technology
(ix) Naval architecture and ship construction

Retraining courses for those who have Class II Certificates and want to obtain Class I Certificates (in order to become captain or chief engineer) are offered in England.

(3) Specific short course training as stipulated by STCW convention

The convention stipulates the training in following areas and PMA is now conducting such training as a special intensive course for certification.

(a) Fire fighting (b) First aid	a) + b)	10 days
(c) Survival at sea		4 days
(d) Deck work		3 weeks
(e) Watchkeeping		4 days

To each course respective certificate(s) is issued.
Record of actual number of trainees attending in 1985.

Training	Number
Fire fighting	381
First Aid	399
Sea Survival	1,503
Deck work	18
Watchkeeping	0

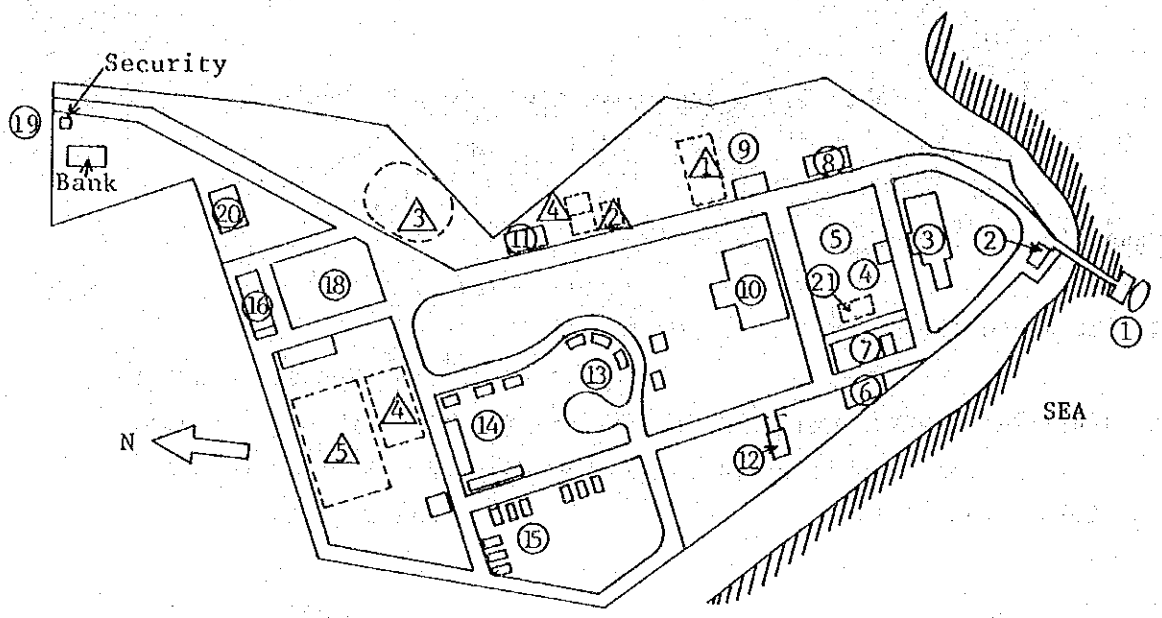
2.4.3 PMA facilities and training equipment

(1) Facilities

The facilities' total area is around 400,000 m^2 and in this area, the main building, mechanical training shop, equipment exhibition hall, seaman training center, cadet dormitory, teachers' residences, a survival training pool etc. are located.

(2) Equipment

The overall layout of PMA is shown in Fig. 2.4.1. The available education & training equipment are listed in Table 2.4.2. Most of these devices both Nautical and Engineering departments are rather old.



Completed

① Jetty
② Boat house
③ Administration & classrooms for cadets
④ Quarter deck
⑤ Parade ground
⑥ Demonstration hall
⑦ Eng' work shop labo'
⑧ Club for teachers
⑨ Library
⑩ Cadet dormitory
⑪ Hospital
⑫ Mosque
⑬ Director general's residence
Deputy director general's residence
⑭ Teachers' residence
⑮ Staff's residence
⑯ Seaman training center
⑰ Seaman's dormitory
⑱ Prade ground
⑲ Gate
⑳ Fire fighting
㉑ Swimming pool

Blueprint

△1 Marine college
△2 Tennis court
△3 Clockey ground
△4 Hockey ground
△5 Football ground

Fig. 2.4.1 Overall Layout of PMA

Table 2.4.2 Training Aids and Equipments

General

1.	Language laboratory	30
2.	Physical laboratory	25
3.	Colour television	2
4.	V.C.Rs.	2
5.	Video films on various nautical and engineering subjects	35
6.	Over head projectors	4
7.	Slide projectors	2
8.	Epidiascope	2
9.	Radio cassette recorder	2
10.	Transparency maker	1
11.	Electric stencil cutter	1
12.	Photo copier machines	4

Training Aids and Equipments

Nautical Department

S. No.	Training aids	Q'ty
1.	Independent concrete jetty.	1
2.	Gravity type davit (for launching and hoisting life boats).	1
3.	Fibre glass life boat with-out engine but with equipment as required by SOLAS - 74.	1
4.	Slewing davit single.	1
5.	Fire fighting appliances.	
	a. A mockup unit equipped with.	1
	(i) Fire detection system.	1
	(ii) Halon 1211 extinguishing system (total flooding).	
	(iii) Sprinkler system.	
	(iv) Breathing apparatus.	
	(v) Portable fire extinguishers.	
	b. Self contained breathing apparatus as required by SOLAS - 74.	1
6.	Navigating bridge accessories for demonstrations and classroom use.	
	a. Charts and plotting equipment.	
	(i) Parallel rulers.	10
	(ii) Compass deviders.	40
	(iii) Station pointers.	3
	b. Azimuth mirrors.	2
	c. Aldis lamp.	3
	d. Sextants.	6
	e. Fog horn.	4
7.	Seamenship and cargo handling equipment (various assorted elementary items such as)	1
	(i) Blocks, purchases.	
	(ii) Shackles.	
	(iii) Thimbles.	
	(iv) Cargo hooks, etc. etc.	

Engineering Workshop

Training equipment

1.	Lathe machines	17
2.	Shapers	3
3.	Milling machine	1
4.	Drilling machines	4
5.	Radial drilling machines	2
6.	Arc welding machines	2
7.	Wood power saw machines	2
8.	Wood lathe machines	2
9.	Wood polishing machine	1
10.	Bench fitting equipment (Complete set)	2
11.	Coal fired demonstration boiler	1
12.	Small diesel engines	2
13.	Fire pump with diesel engine	1
14.	Fuel pump testing machine	1
15.	Grinders	2
16.	Wooden model of complete engine room	1
17.	Working model of M. A. N. two stroke engine	1
18.	Cut away model of 4 stroke engine	1
19.	Indicator diagram instrument	1
20.	Compression/leak pressure recorder	1
21.	Linear calibration instrument	1
22.	Cut away model of centrifugal pump	1

2.4.4 Organization of PMA

PMA's organization is shown in 2.4.2. PMA consists of a training section and an office section, both under the commandant and the deputy commandant.

The training section consists of the nautical department, engineering department, and general educational department. Instructors for the nautical and engineering departments are mostly educated in the United Kingdom and other foreign countries. All are well experienced seamen with Class I qualification certificate and among these six (6) are for nautical and six (6) are for engineering and one (1) technician is for the work shop and electric equipment. The education department has six (6) training officers and one (1) sports officer.

The office section consists of the administrative department, accounting department, medical department, and transportation department. In addition to the above, the academy has seamen training centre under the direct control of the commandant. This center is conducting Life saving, and Fire fighting and other training. The instructors are 6 in all: one class I seamen qualification officer and five class II officer.

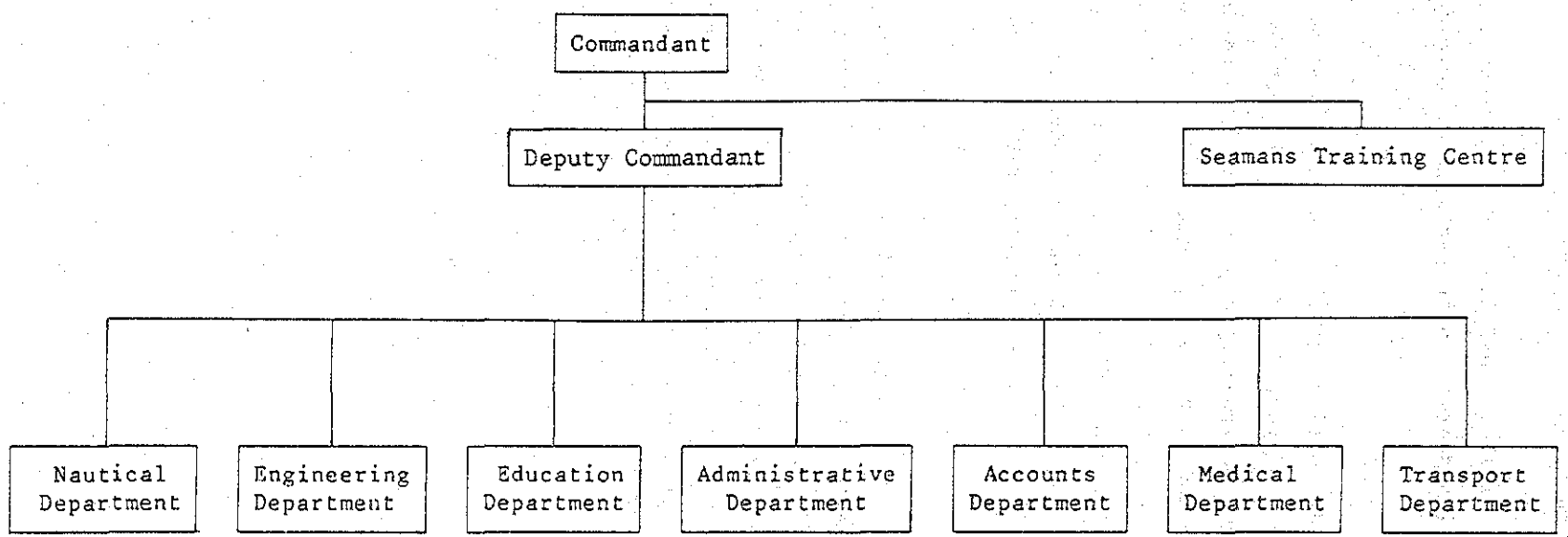


Fig. 2.4.2 Organization of PMA

2.4.5 Budget of PMA

The sum alloted for fiscal 1986/87 is 6.59 million Rupees, including 400,000 Rupees for repair and maintenance of the educational equipment/aids.

The growth of PMA's budget is shown in Table 2.4.3.

Table 2.4.3 PMA Annual Budget

Fiscal year	Budget (Rupees)
1981 - 82	3,287,186
1982 - 83	3,240,950
1983 - 84	3,670,200
1984 - 85	5,569,000
1985 - 86	6,722,000
1986 - 87	6,590,000

CHAPTER 3 CONTENTS OF THE PROJECT

CHAPTER 3 CONTENTS OF THE PROJECT

3.1 Purpose of the Project

At present, Pakistan has 38 vessels (550,000 DWT) and 13,859 registered seamen.

The Ministry of Communications is now controlling the maritime administration and trying hard to promote national shipping business as well as promoting the participation of private business activities in the maritime sector and encouraging the training of a greater number of qualified Pakistani seamen.

In response to a growing international interest in the modernization of navigational equipment and techniques as well as the improvement of safety at sea, the International Maritime Organization has adopted STCW convention for the purpose of raising the level of quality of seamen in each country.

PMA trains Pakistanis who wish to become nautical or engineering officers and retrains post-sea trainees wishing to qualify for a higher certification by conducting special training to which meets STCW convention standards.

In addition to the above, the academy is trying to conduct higher training designed to qualify seamen for the equivalent to the British Class I in Pakistan.

It is under these circumstances that the Government of Pakistan requested the Government of Japan to provide grant aid for educational and training equipment.

As mentioned earlier, PMA is now conducting many kinds of seamen training such as pre-sea training, retraining and other specific training programs such as life saving, fire fighting, first aid etc. Still, the academy is obliged to use Pakistan's actual vessels under service or factory shop

under operation for such training purpose for a considerable period with less educational effect only due to insufficient equipment.

To reach the following target, the necessary educational and training equipment is an urgent need:

1) Upgrading the Pakistan seamen's pre-and-post sea training so as to take advantages of todays renovated on board equipments.

2) Satisfy STCW convention's requirement

3) Highest Class I qualification can be done in Pakistan.

3.2 Contents of the Request

Although the contents of the request had been discussed and agreed upon between Pakistani officials concerned and Japan's preliminary study team, further meetings were held on the detailed examination of the equipment between PMA and Japan's Basic Design Study Team. As a result, the following were confirmed:

1) PMA's available educational and training equipment
   PMA's available educational and training equipment are quite insufficient for the intended purpose; especially for the training of today's modern vessel's equipment and machineries, there are none and the academy is obliged to conduct long hours of class-room lectures with less training practices.

2) Educational plan
   PMA is now conducting pre-sea and post-sea training and others (life saving, fire fighting, first aid etc.) but still relying on the highest seamen's education abroad due to lack of suitable equipment. To overcome such situation, the academy is trying to improve the carriculum to render such highest class education possible in Pakistan.

3) Maintenance and control plan

At present, the academy is trying to secure necessary budget for the repair and maintenance of the equipment, but unlike present stational and non-movable ones, expected equipment needs the utmost careful maintenance system under the control of the instructors' guidance because of the nature of their highly sophisticated mechanism.

4) Manning of maintenance personnel

PMA has six instructors for nautical and six for engineering department for their respective education and further reinforcement of such personnel is under planning to cope with the future situation.

5) Equipment setting location

Necessary buildings are already available to accommodate the equipment in accordance with the plan.

Above is the outline of this time's analysis. And in selecting the equipment, they should be:- of the character that cannot be substituted by other equipment, less local cost at their setting, operating and maintaining and playing their role in a most satisfactory manner under the academy's reasonable control and also causing no contradiction with the present technical level of Pakistan and PMA's instructor's past experiences and capabilities. Content of the requested equipment is shown in the attached Appendix-1, the academy's officer's qualifying examination papers are also referred to in this report preparation.

3.3 Contents of the Project

3.3.1 Executing agency

The Pakistani authority directly concerned with this project is PMA under the jurisdiction of the Ministry of Communications. The buildings to accommodate the expected training equipment have already been completed with necessary electrical sources and wiring. All the instructors for nautical and engineering training were trained overseas, mostly in the United Kingdom, with the highest

Class I qualifications. This means that they just receive additional instruction at the initial stage, on the handling, maintenance planning curriculum and other related expertise for the expected training equipment. After the instructors master these, PMA will be able to establish its own curriculum based on its original purposes.

3.3.2 Educational and training curriculum

PMA is now planning for pre-sea training, retraining and other short term education in the following manner:

a. Pre-sea cadets
   - 40 trainees for nautical and engineering training

b. Retraining
   - 200 trainees for nautical training
   - 190 trainees for engineering training
   - 120 trainees for navigational computer and engine control training

c. Other short-term educational programs
   - 880 trainees for fire fighting training
   - 880 trainees for first aid training
   - 2,500 trainees for training of survival at sea
   - 300 trainees for deck work training
   - 100 trainees for watch keeping training

At the time of pre-sea training, classroom lectures occupy the greater part of training due to a lack of adequate educational equipment; of a total of 1,440 hours (2 years), 153 hours for Deck Cadets and 376 hours for Engine Cadets are allocated for their practical training respectively. But the content of this training at present appears to be on an unsatisfactory level. For example, only 8 hours are allocated to electronic navigation, which is the core of today's navigational technology. This shows the lack of suitable equipment and accordingly less practical training being conducted,

and thus the expected educational effects are not satisfied at present. Under such circumstances, PMA commenced the carriculum improvement work both for cadets and qualified seamen by taking advantage of Japan's equipment aid program for the successful execution of educational training, the contents of which are shown in Appendix-6. Also this content is aiming to raise seamen's technical level for various modernized ship handling.

3.3.3 Equipment planning

The most appropriate scale and magnitude of equipment suited for many kinds of training based on PMA curriculum (Appendix-6) have been recommended through careful consideration of the following conditions:

1) Forty (40) trainees constitute one (1) Class
2) The equipment employed or placed on board actual Pakistani vessels at present, i.e. 10,000 - 20,000 DWT conventional cargo, and the equipment for the vessels being planned such as container vessels (1,200 (TEU), Multi-purpose cargo with container (600 TEU), Bulk Carrier 50,000 DWT have been studied in detail for this purpose.
3) The equipment planned will incur minimal local costs and maintenance expenditures.
4) The equipment planned will be compatible with the current state of the art in Pakistan.

(1) Radar Simulator

Collisions and groundings due to misoperation are the most frequent causes of serious accidents at sea.

Marine radars have been developed for safer navigation especially in poor visibility, and now are indispensables for sea going ships.

Meanwhile, accidents at sea due to poor skill in radar operation and analysis of displayed reflection are increasing.

Recently, collision avoidance aids - Automatic Radar Plotting Aids (ARPA)-, which analyze the radar reflection, automatically plot the movements of the ownship and target ships and indicate the expected directions of such ships' movements, have been developed and since validation of 1981 AMENDMENTS TO THE INTERNATIONAL CONVENTION FOR THE SAFETY OF LIFE AT SEA, 1974 have been required to be equipped onboard.

As mentioned above, even the equipment aimed at making ship's navigation safer may cause serious accidents if poorly operated, and the International Convention on STCW adopted the special resolution recommending training of radar navigation and radar plotting.

For this training, repeated hard exercises are necessary until the trainees can readily make a proper reaction against the various conditions given by the instructor.

Radar simulator can generate mimic severe conditions which can hardly be experienced on real ships, and record the trainees' responses so that proper guidances can be given to the trainees, and thus, is the most suitable training equipment for this purpose.

Therefore, one set of radar simulator should be provided.

The simulator should be composed of an own ship section, an instructor's section, a signal processing section and accessories. The number of targets should be 20 as stipulated in the recommendation by the International Maritime Organization (IMO) for the minimum targets automatically plotted.

Considering that at most five trainees can be virtually deployed at an own ship set and assuming a class of 40 trainees to practice in two shifts, the number of own ships should be four to give training to 20 of the trainees at a time.

(2) Celestial navigation

A position-fixing by an astronomical observation at sea is a fundamental of navigation, and it is most important to keep an accuracy of position obtained by this method.

Ship's officers are required to be familiar with taking a good chance and a suitable celestial map, in order to know the time accurately by chronometer from the changes of movements of celestial bodies and to fix own position exactly by observing an angle of elevation in sextant.

To give ship's officers a fundamental knowledge of this astronomical navigation easily, three globes set, celestial globe model and a small type of planetarium, which can show easily the relation between the earth and celestial bodies, should be equipped with the plan.

Portable type of three globes set and celestial globe model should be provided, considering the usage in the classroom.

The planetarium has been adopted on a scale which can be projected in the classroom.

(3) Compass

Compasses are the fundamental nautical instrument used for not only judging the present ship position on a chart by taking angles with targets, but keeping her right course at sea.

There are two kinds of compasses, magnetic and gyro. Navigating officers are required to acquire the method of correction against ship course errors caused by the earth's magnetic field as for magnetic ones, and a way of the operation and care of gyro compass.

For the training of compasses, both magnetic and gyro compasses should be provided. The gyro scope should also be provided for having a knowledge of gyro theory.

The scale of both compasses should be as big as the ones for 10,000 to 20,000 tons class ocean going vessels.

(4) Life raft

All seafarers are required to have the knowledge and handling technique of life-saving equipment. Life rafts are the one of the most important appliance for ships to keep the safety of life at sea in an emergency. The 20-passenger life raft, the standard model for the ocean going vessels, should be provided for the boarding practice of training on the pool.

(5) Model of typical ship

In recent years, ships have been specialized in order to transport their cargo efficiently instead of conventional general cargo ships.

It is necessary for training to give trainees fundamental knowledge of special feature of each ship, such as general arrangement, appearance and function of outfittings, etc.

To know how the hull strength members are arranged in each type of ships can help trainees to understand ship's structure and feature.

Ships are too huge to study their actual structure and feature, then it becomes useful for trainees to understand them easily by using ship drawings and various models of specialized ship, general cargo ship and their hull structure.

Therefore, following ship models should be provided:

Considering the study in the classroom, the scale of each model is to be 1/200 for ship models and 1/100 for hull structure (bow section, mid section, stern section) respectively.

1) Typical ship model (scale: 1/200)

a) Oil tanker
b) Bulk carrier
c) Container ship
d) Roll-on/Roll-off ship
e) General cargo ship

2) Hull structure model (scale: 1/100)

a) Bow section
b) Mid section
c) Stern section

(6) Loading calculator

The trend of larger size and specialization of ships has added another important factor for better performance of ships in terms of carrying capacity and operation to ship's design condition.

Improper loading against the designed hull strength or stability would cause dangerous troubles, during the voyages.

Therefore, loading plan must be confirmed to fit the ship's design criteria.

Usually, loading calculators are used for this purpose. The loading calculators have built-in programs giving the following outputs against the input data of cargo to be loaded, quantities of fuel, fresh water, etc. and cargo loading plan:

1) bending stresses, shearing stresses, etc. of hull
2) stability
3) drafts, trim and heel

In this project, a loading calculator should be provided for training of loading planning for three typical kinds of ships (bulk carrier, general cargo ship and tanker).

(7) Model of cargo gear

Safety and efficiency in cargo handling plays an important role in ship's operation.

For learning of various cargo gears' components and mechanisms, and preparation work and operation of such cargo gears, models of, among others, two typical cargo gear systems — an ordinary derrick boom system and a heavy derrick boom system — should be provided.

The models' block layout, wiring and winch layout and driving mechanisms should be the same as the real ones to illustrate the complicated mechanisms clearly.

The scale should be 1/30, considering the models to be used in the classrooms.

(8) Cut away model

These days, machineries have become lighter with higher performance.

In the field of diesel engines, an output per cylinder volume has grown twice for these 30 years due to technical development.

Similar development has been seen in various auxiliary machineries.

In education, the question is how to have students understand such developed machineries in a short time.

The most effective way is to provide real engine plants and to give training with the plants.

However, it is impractical due to intolerably high costs of such facilities and their maintenance.

As an alternative means of education about internal structure, mechanisms and maintenance of the machineries, hand-operated cut models are used.

PMA has an engine room model cut into two parts for learning of arrangement of the engine room, but few education material for internal structure or mechanisms of machineries.

Therefore, hand-operated cut models of 16 machineries including two-cycle diesel engine should be provided.

Considering that PMA already has a four-cycle diesel engine model and that exhaust gas economizer models are less necessary, these models are not included in this project.

(9) Various types of valves

There are a lot of various types of valves fitted on the pipeline of water, oil, air, gas, etc. including safety relief valves for prevention of abnormal pressure-up of the reservoir or compartment of machinery on board.

Furthermore, as the valve standard widely range from high pressure to low pressure with the rules and regulations and valves for marine-use abound in kinds, learning of technical knowledge of the valve structure together with its function, and skills of technique of the maintenance are absolutely necessary for seamen in charge who should safely handle them on board.

Using real valves as samples can bring remarkable training effects in the technique of overhauling, assembly, face-up, adjustment, pressure-test of valve body, etc.

The valves commonly fitted on the ordinary ocean-going vessels and of minimum size available to have trainees understand their structures should be provided.

(10) Testing and measuring equipment

Engine room plants of modernized vessels have been unmanned by the development of electric automatic control equipment, etc.

Generally, no specialists for electric and electronic control equipment are on board and engineer officer should be in charge of the operation, maintenance as well as repairs of these equipment.

Therefore, testing and control equipment for educational and practical training purpose covering from basic knowledge to applied technique of measuring and controlling equipment should be so provided that the engineer officer should have a thorough knowledge of these kinds of control process.

They are composed of control equipment including pneumatic and electric process control equipment, electronic equipment such as transistor circuit trainer and various kinds of testing equipment for steel material, etc.

Number of sets and specifications of equipment are so determined that 40 (forty) students of engineering department could be trained alternately in groups.

(11) Workshop machine

Engineer officers should have as much technique of emergency repairs against hull damage and engine trouble at sea as possible.

At present, PMA has such machinery as lathes, planer, milling machine, arc welders, etc. as shown in Table 2.4.3.

PMA has four arc welding machines, however, those are all obsolete and are often in the condition under repair.

Therefore, one set of arc welder should be newly provided to keep the present level of training curriculum.

One lapping machine for grinding job of main engine exhaust valve seat should be newly included in the teaching materials so that the training may be enhanced.

(12) VHF radio telephone

VHF radio telephones (standard type for ocean going ships) which deck part crew must learn to operate should be provided.

Two sets should be supplied so that training of transmitting and receiving can be done at the same time.

(13) Ship maneuvering simulator

In recent years, to promote safety of life and property at sea and protection of the marine environment, the improved qualification of senior officers and duty officers for maneuvering and

handling of a ship in all conditions is required in international maritime operation.

Under such circumstances, the Pakistani government has had the highest senior officers (equivalent to Class I in the British qualification standards) receive retraining in the foreign countries, but is now planning to give such retraining at its own institute by improving and expanding PMA's facilities as mentioned before.

The training of maneuvering and handling of a ship with a training vessel may be effective, however, it takes much cost to construct, to operate and to maintain her.

As an alternative, one set of ship maneuvering simulator should be provided so that the basic training of ship maneuvering as well as the retraining of great deal of senior officers can be carried out.

The simulator with the mimic bridge compartment and the visual screen in front, should enable the trainees' practice under the navigational conditions preprogramed by the instructor and also enable the instructor to give proper advice based on the evaluation of the trainees' responses logged by the simulator.

This simulator should consist of training section, instructor's section and systems control section.

A 120 degrees visual screen should be mounted in front of the mimic bridge compartment, and the equipment of bridge compartment such as bridge console, radar, ARPA and electronic navigational aids (Omega, Decca, Satelite navigator, Loran, Radio direction finder, Echo sounder) should be arranged in the mimic bridge compartment as in real ships.

In the instructor's section, the equipments for setting training conditions, seeing operation and also recording the result of training should be provided.

There should be data processing unit, visual control unit, etc. in the system control section.

The number of targets in the visual screen is about 8 considering actual condition of oceangoing.

Three slave radars should be provided so that the rest of the trainees can also understand the training condition while other trainees are role-playing.

(14) Engine plant simulator

The engineer officer in charge of the watch in machinery space should understand overall system including main engine and its related auxiliary machines as well as propulsion system and also have skills of operation and watchkeeping technique.

Putting it in the concrete, the engineer officer should have capability of operation, watchkeeping, trouble-detection, cause-tracing and restoring to the original condition as well as taking the emergency measures.

Accordingly, the following two training items are of vital importance for engineer officer.

1) Training of basic operation procedure at each manoeuvring mode from undocking to normal sea-going.

2) Training of trouble-detection, cause-tracing and restoring to the original condition.

In order to carry out the effective training of the above items repeatedly, engine room plant simulator is most suitable.

This simulator planned for PMA gives to the trainees the operating conditions at each manoeuvring mode and also trouble conditions by the mimic signals generated by an instructor and records the input orders and/or setting conditions as well as the responses of trainees with time indication which the instructor judges and evaluates good or not.

Simulator mimics the engine control room of actual motor vessel and consists of engine control console, main switchboard, graphic panel, etc. for trainees, instructor's console, the attached computers and so on.

Graphic panel shows the system structure of engine room plant and indicates the operating conditions of each machinery.

Instructor introduces initial conditions, ship's operation mode and control mode prior to start training and various troubles and alarms of the engine plant by the input of the training program through switches on the instructor's console.

Trainees are trained by operating the manoeuvring handle and various switches on the main and auxiliary control console, graphic panels in accordance with the operation procedure or in response to the troubles and alarms.

Mimic trouble items generated should be about 150 in number considering the actual conditions of ocean-going vessel.

3.3.4 Manning plan for the equipment

At the time when the planned equipment are set in position as scheduled, present number of personnel in this academy who are supposed

to take charge of the equipment is considered insufficient for the effective handling and maintenance of them. At present, the academy has a plan to increase seven more staffers: 2 Nautical Dept. 4 Engineering Dept. and 1 Educational Dept. respectively. This means a teaching staff of 34 and 13 people as administrative staff and assistants are planned to engage in this job.

This number is considered to be reasonable. Refer to Appendix-7.

3.3.5 Technical cooperation

PMA requested the Japan's technical cooperation. A proposal consisting of four requests was presented at the field survey. The contents of the proposal are summarized below.

(1) Maintenance training
PMA has requested that two PMA officers and three PMA engineers be dispatched to Japan for training in equipment maintenance.

(2) Instructor training for equipment handling
It is requested that PMA instructors be dispatched to appropriate institutions in Japan for training in handling these institutions' equipment. The training should include the use of simulators.

- No. of instructors: 3 to 5
- Training period: 4 to 6 months

(3) Japanese experts
PMA has requested that Japanese experts be dispatched to PMA to maintain and operate the equipment supplied as well as to train PMA instructors on the maintenance and operation of the equipment.

- No. of experts: At least 2
- Period of stay: At least 1 year

(4) Familiarization study

PMA has requested that as part of the process of procuring the equipment, senior officials of both PMA and the Ministry of Communications (whose jurisdiction includes PMA) visit Japan to become familiar with the equipment. Their stay in Japan should include inspection tours of training institutions for Japanese seamen, training ships and equipment manufacturers.

- No. of officials: 3 to 5
- Period of stay: 3 to 4 weeks

Studies of the current training situation and seaman qualification examinations at PMA have led the Basic Design Study Team to conclude that technical cooperation should center on two major points; (1) training in the maintenance and operation of the equipment, and (2) preparation of a curriculum to take advantage of the equipment.

Taking into account the above results of the studies - in specialization, educational effects and efficiency, it is recommended that Japanese experts and Pakistani trainees be classified, according to their backgrounds, into two departments, Deck and Engine, before they are dispatched or accepted. In addition, the trainees should be selected from the present instructors of PMA. They should be divided into two courses: maintenance and operation. This will allow the trainees to concentrate on their specialties effectively.

Based on the foregoing, the following framework of technical cooperation are recommended.

(1) Training in equipment maintenance

- No. of trainees: 2 (1 in navigation and 1 in engineering; both to be PMA instructors)
- Period: Around 3 months
- Place: Equipment Maker's Shop or Navigational Institute

(2) Training in equipment operation

- No. of trainees: 2 (1 in nautical and 1 in engineering: both to be PMA instructors)
- Period: Around 3 months
- Place: Equipment Maker's Shop or Navigational Institute

(3) Dispatch of Japanese experts in equipment maintenance and operation

- No. of experts: 2 (1 in nautical and 1 in engineering)
- Period: Around 12 months

(4) Dispatch of Japanese experts in curriculum preparation

- No. of experts: 2 (1 in nautical and 1 in engineering)
- Period: Around 6 months

CHAPTER 4 BASIC DESIGN

CHAPTER 4 BASIC DESIGN

4.1 Basic Policy of the Basic Design

The basic design of the equipment has been carried out in accordance with the following principles:

(1) Educational objective to be attained

The objectives of training with the requested equipment are: (1) to train pre-sea and post-sea nautical officers and engineers, (2) to offer programs allowing seamen to acquire the qualifications stipulated by international conventions such as STCW convention, and (3) to train upper class seamen (senior class in the British qualification system).

(2) Compliance with the curriculum

Educational training equipment is necessary as a supplementary aid in carrying out the curriculum and providing an improved education. Preliminary studies of the existing curriculum revealed that it clearly reflected the lack of certain equipment through the lopsided emphasis placed on some topics and the little attention paid to others. And the curriculum appears to need some revision in order to take advantage of the additional equipment. (Appendix-6)

A newly revised curriculum should address primarily two groups of trainees; (1) cadets with neither knowledge nor experience as seamen and who must be trained in general and basic knowledge, applied techniques and other related practical skills in order to become professionals capable of manning ships, and (2) experienced seamen who wish to acquire higher qualifications. The new curriculum should also have programs in basic techniques not only for operation but also for maintenance.

(3) Location of the educational equipment

The equipment will be placed so that the instructor can monitor his students' interaction with the devices during a training session. Care must be taken to get maximum educational effect from the layout etc.

(4) Standard to be applied

As educational material, the equipment does not have any rules applicable to it. However, when designing and manufacturing the equipment, the actual ship must be kept in mind. Therefore, the following rules must be referred to: SOLAS rules, IMO recommendations.

The samples of various type of valves and materials needed for production of the equipment shall be those produced using JIS material. For materials used in electrical work, JEM standard material shall be used.

Notes: SOLAS The International Convention for the Safety of Life at Sea
IMO International Maritime Organization
JIS Japanese Industrial Standard
JEM Japan Electric Machine Industry Association Standard

4.2 Study on the Natural Conditions for the Design

In Karachi where PMA is located, the temperature ranges from 5°C to 25°C in winter and from 23°C to 43°C in summer, with humidity 44% to 64% in winter and 70% to 95% in summer. Rainfall is minimal. The land is arid and occasionally swept with gusty winds containing sand.

The power supply needed for the equipment in the room is: 3-phase 50-cycle 440 V on the high voltage side and single phase 50-cycle 220 V on the low voltage side. The power outlet is already available in the room.

To cope with the high-temperature, high-humidity and occasional sand storms, each simulator room should be properly air-conditioned and sealed against the intrusion of foreign matter. Since a lot of static electricity is generated during certain seasons, each simulator, especially its computer-related sections, should be grounded so as to release the charged electricity.

Care must be taken to support the load evenly on top of a beam or other stiffening member.

4.3 Basic Design

Outline specifications, numbers and principal particulars of the educational equipment according to the basic design are mentioned below.

Name and number of the equipment are as follows:

(1) Radar simulator

1)	Radar simulator (incl. Automatic Radar Plotting Aids = ARPA, air conditioner and cover)	1 set

(2) Celestial navigational training set

1)	Three gloves set	1 set
2)	Transparent celestial glove model	1 set
3)	Mini planetarium	1 set

(3) Compass

1)	Magnetic compass training set	1 set
2)	Gyro compass training set	1 set
3)	Gyro scope	1 set

(4) Life raft

1)	Life raft	1 set

(5) Model of typical ship

1)	Ship models (Oil tanker, Container ship, Bulk carrier, General cargo ship, Roll-on/Roll-off ship)	1 set each
2)	Hull structure model (Bow, Mid, Stern)	1 set each

(6) Loading calculator

1)	Loading calculator	1 set

(7) Model of cargo gear

1)	Movable cargo gear (Ordinary type, Heavy derrick boom type)	1 set each

(8) Cut away model for engineer department

1)	Two-cycle diesel engine	1 set
2)	Thrust bearing	1 set
3)	Marine steam turbine	1 set
4)	Exhaust gas turbocharger	1 set
5)	Marine boiler	1 set
6)	Various type of pumps (Centrifugal pump, Piston pump, Geared pump, Fuel injection pump, Hydraulic oil pump)	1 set each
7)	Gears (Spur gear, Planetary gear, Bevel gear)	1 set each
8)	Stern tube with propeller and shaft	1 set
9)	Controllable pitch propeller	1 set
10)	Side thruster	1 set
11)	Steering gear (Ram type, Vane type)	1 set each

12)	Deck machinery (Mooring winch, Windlass, Capstan)	1 set each
13)	Cooler (Plate type)	1 set
14)	Refrigerating plant with compressor	1 set
15)	Generator	1 set
16)	Electric motor	1 set

(9) Samples of various type of valves

1)	Air valve for starting main engine	1 set
2)	Fuel injection valve for main engine	1 set
3)	Main engine cylinder safety valve	1 set
4)	Glove valve	1 set
5)	Angle valve	1 set
6)	Sluice valve	1 set
7)	Butterfly valve	1 set
8)	Swing check valve	1 set
9)	Air-operated diaphragm valve	1 set
10)	Pressure control valve	1 set
11)	Pilot type temperature control valve	1 set
12)	Pressure reducing valve	1 set

(10) Testing and measuring equipment

1)	Pneumatic and electric process control device	1 set
2)	Various type of sensors (Pressure, Level, Temperature, Flow)	1 set each
3)	Speed governors (All speed type, Constant speed type)	1 set each
4)	Induction regulator	1 set
5)	Transister circuit trainer for cadets	5 sets
6)	Integrated circuit trainer for cadets	5 sets
7)	Transister and I.C. circuit trainer for instructor	1 set
8)	Microcomputer experiment device	5 sets

9)	Impact tester	1 set
10)	Vickers hardness tester	1 set
11)	Brinell hardness tester	1 set
12)	Fuel injection valve tester	1 set
13)	Boiler water tester	2 sets
14)	Gas analyzer	1 set
15)	Fuel oil analyzer	1 set
16)	Red wood viscosity meter	1 set
17)	Saybolt viscosity meter	1 set
18)	Englar viscosity meter	1 set
19)	Planimeter	1 set
20)	Flow meter	1 set
21)	Vibration meter	1 set
22)	Oil hydraulic circuit trainer	1 set
23)	Pneumatic circuit trainer	1 set
24)	Electric circuit tester	1 set
25)	Logic analyzer	1 set

(11) Work shop machine

1)	Arc welding machine	1 set
2)	Lapping machine	1 set

(12) VHF radio telephoe

1)	VHF radio telephone	2 sets

(13) Ship maneuvering simulator

1)	Ship maneuvering simulator (With air conditioner and cover)	1 set

(14) Engine plant simulator

1)	Engine plant simulator (With air conditioner and cover)	1 set

4.3.1 Radar simulator (with automatic radar plotting aids, air conditioner and cover)

(1) Equipment makeup

This simulator consists of an own ship section, an instructor's section, a signal processing section and accessories (with computer).

The own ship is equipped with an Automatic Radar Plotting Aids (ARPA) which analyse the radar reflection, automatically, plot the movements of the own ship, target ships, marks, etc. and indicate the expected directions and speeds of such ship's movement as vectors.

The instructor's section runs the equipment for setting training conditions by preprogrammed information. The effective training of radar navigation and collision avoidance should be carried out using this equipment.

Each own ship can simulate up to six types of ships and can maneuver individually.

(2) Quantity of equipment components and their specifications

Component name	Device name	Q'ty	Specification
(1) Training section	Control console	4 sets	Steering wheel, engine telegraph, compass repeater, speedmeter, engine tachometer, rudder angle indicator, etc.
	Radar display	4 sets	True bearing unit with 16-inch CRT, and true motion display Switchable range: 0.25 to 120 miles Variable distance scale range: 0.01 to 120.0 miles
	ARPA	4 sets	
(2) Instructor's section	Instructor's console	1 set	Equipment control and monitoring functions with 14-inch color CRT
	X-Y plotter	1 set	Function of recording wakes on sheets of A3 in size
	Printer	1 set	Dot matrix type
(3) Others	Control panel	1 set	
	AVR	1 set	
	Distribution panel	1 set	
	Packaged air conditioner	1 set	

4.3.2 Celestial navigational training set

(1) Equipment makeup

The equipment is made up of three-globe set, a transparent celestial globe model, and a mini-planetarium. Knowing the location of the sun in the simulated celestial environment, trainees should be able to determine the ship's position relative to the moon, fixed stars and planets all of which emitting light.

(2) Quantity of equipment components and their specifications

Component names	Q'ty	Specifications
(1) Three-globe set	1 set	
(2) Transparent celestial globe model	1 set	Dia. 340 mm
(3) Mini-planetarium	1 set	Dia. 3.0 m, 10-person type

4.3.3 Compass

(1) Equipment makeup

There are two major types of compass: a magnetic compass and a gyro compass. The magnetic compass to be supplied will have mechanisms that allow detected measurement errors to be adjusted. The gyro compass will be of a type that permits easy training in handling it and in understanding how it works.

(2) Quantity of equipment components and their specifications

Component names	Q'ty	Specifications
(1) Magnetic compass training set	1 set	with adjustment device
(2) Gyro compass training set	1 set	
(3) Gyro scope	1 set	

4.3.4 Life raft

(1) Equipment makeup

The life raft will be housed in its container when delivered. A cylinder containing gas to inflate the raft and an emergency light will also be provided.

(2) Quantity of equipment components and their specifications

Component names	Q'ty	Specifications
(1) Life raft	1 set	20-person type

4.3.5 Model of typical ship

(1) Equipment makeup

The models are consisting of 5 kinds of ship models and 3 kind of hull structure models.

(2) Quantity of equipment components and their specifications

Component names	Q'ty	Specifications
(1) Ship model	1 set each	Oil tanker, container-ship, bulk carrier, general cargo ship, roll-on/roll-off ship (on 1/200 scale each)
(2) Hull structure model	1 each	Midship, bow and stern (on 1/100 scale each)

4.3.6 Loading calculator

(1) Equipment makeup

The equipment consists of operator's console, function buttons, numbered buttons and tank and hold arrangement plate.

(2) Quantity of equipment components and their specifications

Component names	Q'ty	Specifications
(1) Loading calculator	1 set	Capable of doing various calculations including those regarding ship's stability

4.3.7 Model of cargo gear

(1) Equipment makeup

These models are of the movable type and through handling them, the trainees can confirm the rigging and cargo handling work of conventional derrick and boom system. In addition to this, heavy derrick and boom type one is also included.

(2) Quantity of equipment components and their specifications

Component names	Q'ty	Specifications
(1) Movable cargo gear	1 each	Ordinary type Heavy Derrick type

4.3.8 Cut away model

(1) Equipment makeup

The models will mainly consist of cutaway models of 16 auxiliary machines. Large models will be made of wood, and small ones will be cutaway models of the real devices. The structures of the models will be such as to permit easy inspection of their internal mechanisms. Some models may be working types where necessary.

(2) Quantity of equipment components and their specifications

Component names	Q'ty	Specifications
(1) Two-cycle diesel engine	1 set	1 cylinder
(2) Thrust bearing	1 set	
(3) Marine steam turbine	1 set	
(4) Exhaust gas trubocharger	1 set	
(5) Marine boiler	1 set	
(6) Pumps	1 each	Centrifugal pump, piston pump, fuel oil injection pump, hydraulic oil pump, gear pump and screw pump
(7) Gears	1 each	Spur gear, planetary gear and bevel gear
(8) Stern tube incorporating propeller and shaft	1 set	
(9) Controllable pitch propeller	1 set	
(10) Side thruster	1 set	Controlable pitch propeller
(11) Steering gear	1 each	Ram and vane type
(12) Deck machinery	1 each	Mooring winch, windlass and capstan
(13) Cooler	1 set	Plate type
(14) Refrigerating plant with compressor	1 set	
(15) Generator	1 set	
(16) Motor	1 set	AC motor

4.3.9 Various type of valves

(1) Equipment makeup

Twelve actual valves will be provided.

(2) Quantity of equipment components and their specifications

Component names	Q'ty	Specifications
(1) Air valve for starting main engine	1 set	
(2) Fuel injection valve for main engine	1 set	
(3) Main engine cylinder safety valve	1 set	
(4) Globe valve	1 set	
(5) Angle valve	1 set	
(6) Sluice valve	1 set	
(7) Butterfly valve	1 set	
(8) Swing check valve	1 set	
(9) Air-operated diaphragm valve	1 set	32 mm ϕ
(10) Pressure control valve	1 set	25 mm ϕ
(11) Pilot-type temperature control valve	1 set	25 mm ϕ
(12) Pressure reducing valve	1 set	25 mm ϕ

4.3.10 Testing and measuring equipment

(1) Equipment makeup

The equipment will be a pneumatic and electronic control device, electric and electronic circuit training sets, testers and measuring instruments. Trainees will be taught how to handle and operate these devices properly.

(2) Quantity of equipment components and their specifications

Component names	Q'ty	Specifications
(1) Pneumatic and electric process control device	1 set	For training in air and electric process control
(2) Various type of sensors	1 each	Pressure, level, temperature, flow
(3) Governors	1 each	All speed, constant speed
(4) Induction regulator	1 set	Actual device
(5) Transister circuit trainer for cadets	5 sets	For experiments with electronic circuit
(6) Integrated circuit trainer for cadets	5 sets	For basic experiments with integrated circuits (desk top type)
(7) Transister and I.C. circuit trainer for Instructor	1 set	For basic experiments with electronic and integrated circuits (large-scale training type)
(8) Micro computer experiment device for cadets	5 sets	For microcomputer experiments
(9) Impact tester	1 set	
(10) Vickers hardness tester	1 set	
(11) Brinell hardness tester	1 set	
(12) Fuel injection valve tester	1 set	
(13) Boiler water tester	2 sets	
(14) Gas analyzer	1 set	
(15) Fuel oil analyzer	1 set	
(16) Red wood viscosity meter	1 set	
(17) Saybolt viscosity meter	1 set	
(18) Engler viscosity meter	1 set	
(19) Planimeter	1 set	
(20) Flow meter	1 set	
(21) Vibration meter	1 set	
(22) Oil hydraulic circuit trainer	1 set	
(23) Pneumatic circuit trainer	1 set	
(24) Electric circuit tester	1 set	
(25) Logic analyzer	1 set	

4.3.11 Workshop machine

(1) Equipment makeup

The equipment will be an arc welding machine and a lapping machine.

(2) Quantity of equipment components and their specifications

Component names	Q'ty	Specifications
(1) Arc welding machine	1 set	AC Arc 300 Amp
(2) Lapping machine	1 set	Electric driven type (for exhaust valves)

4.3.12 VHF radio telephone

(1) Equipment makeup

The VHF radio telephone will be provided.

(2) Quantity of equipment components and their specifications

Component names	Q'ty	Specification
(1) VHF radio telephone	2 sets	Model for use on board ocean-going vessels

4.3.13 Ship maneuvering simulator (with air conditioner and cover)

(1) Equipment makeup

The equipment consists of a mock bridge with navigational instruments, a main engine control console, a steering gear system, various gauges and indicators, a simulated field of vision generator, a simulated sound generator, computer devices, an instructor console, and their attachments. The simulator provides a very convincing maneuvering environment in which the trainee feels as if he were actually on board ship.

(2) Quantity of equipment components and their specifications

Component name	Device name	Q'ty	Specification
(1) Training section	Control console	1 set	Steering wheel, Engine telegraph, speedmeter, tachometer, rudder angle indicator, etc.
	Radar display	1 set	16"
	Slave radar display	3 sets	16"
	ARPA with display		16"
	Electronic navigational aids	1 set	Omega, Decca, NNSS, Loran C, Doppler sonar Echo Sounder Direction Finder
(2) Instructor's sections	Instructor's console (main)	1 set	For radar simulator
	Instructor's console (sub)	1 set	For electronic navigational aid
	X-Y plotter	1 set	
	Printer	1 set	
	Monitor radar display	1 set	
	Video Monitor	1 set	
(3) Controller	Control panel	1 set	
(4) Others	Video projector	1 set	
	Screen	1 set	120 degrees visual screen
	Distribution panel	1 set	
	AVR	1 set	
	Packaged air conditioner	1 set	

4.3.14 Engine plant simulator (with air conditioner and cover)

(1) Equipment makeup

The simulator consists of an engine control console, a centralized engine monitor, an auxiliary machine control panel, a graphic panel, a simulated sound generator, an instructor's console (for condition setting), CRT, a computer and a printer. These devices are the same as those installed in the engine room and engine control room of an actual motor ship. The simulator provides a convincingly simulated environment in which the trainee can feel as if he were actually on board ship.

(2) Quantity of equipment components and their specifications

Component name	Device name	Q'ty	Specification
(1) Training section	Graphic panel	1 set	
	Control console	1 set	
	Main switchboard	1 set	
	Group starter	1 set	
	Refer container monitor system	1 set	
(2) Instructor's section	Instructor's console	1 set	Condition setting
(3) Mimic sound generation equipment		1 set	
(4) Computer and peripherals		1 set	CRT signal generator Printer (Alarm and data logging)
(5) Others	AVR	1 set	
	Distribution panel	1 set	
	Packaged air conditioner	1 set	