a) Organization

The Shipbuilding Technology Center is established as an affiliated authority of MARINA. Organization of the STC and number of staff (in parenthesis) are as follows;

Director General (1)

Administration Division
- Director (1)
- General Affair Section (8)
- Accounting Section (6)

Ship Structure Division
- Director (1)
- Ship Dynamics and Propulsion Section (6)
- Structure Mechanics Section (4)
- Ship Equipment Section (4)

Ship Engine Division
- Director (1)
- Power and Energy Engineering Section (6)
- Material and Processing Section (4)
- System Engineering Section (4)

Instrument Division
- Director (1)
- Electric Device Section (4)
- Navigational Instrument section (4)

b) Tasks

(1) Type Approval Test for on board machinery, equipments, instruments, etc.

- Material Tests;
  - stretching test
  - pressing test
  - impact test
  - bending test
  - shearing test
  - weathering test
  - repeating load test
  - other tests

- Engine and Electric Devices Tests;
  - starting test
  - load test
  - endurance test
  - other tests

- Designated Tasks;
  - tests to amend or confirm ship safety standard
  - study of new instruments
  - other specific studies

(2) Training of Ship Inspection Officers

  - standing inspection procedure based on PMMRR (structure, engine, electric apparatus)
  - standard for approval by item

(3) Training of Laboratory Works for Students entrusted with from Shipbuilding Engineering Education Entities

- Model Tank Works;
  - towing experiment
  - self-propulsion experiment
  - maneuvering experiment
  - other experiments
- Engine, Electric Devices and Others;
  - decomposition, composition, adjustment
  - starting test
  - load test
  - endurance test
  - other experiments
- Design and Drafting;
  - models for teaching materials
  - drawing boards
  - other experiments

c) Facilities

(1) Buildings
  - administration office, teacher rooms, study rooms and design/drafting room.

(2) Test Houses
  - water tank with wave making apparatus (5m x 50m)
  - circular water tank
  - other test apparatuses
  - engine laboratory
  - electric laboratory

(3) Open-air Rectangular Water Tank with wave making apparatus (40m x 40m)

(4) Computer System

(5) Storages

d) Costs
Facilities are scheduled to be installed step by step taking 10 years from 1996 until 2005. Staff is

increased in time to facility installation. Total cost of facility installation becomes 602 million pesos.

Operating costs is covered by national budget in general, but the principle that beneficiaries should pay for a project is applied to "type approval" tests and training for students.

2.5 Implementation Program

Figure 2.2 shows implementation program.

Proj. Code	Project	1992-1995	1996-2000	2001-2005	2006-2010
201	Execution of ship inspection	------	------	------	------
202	New ship inspection body	-----			
203	Importation assistance	------	------	------	------
204	Financial assistance	------	------	---	
205	Amendment of PMMRR and setting of additional rules	------	------	------	------
206	Domestic production policy	------	------	------	------
207	Scrap and build policy	------	------	----	
208	Introduction to soft loan for industry modernization		------	------	------
209	Maritime industry cooperation system		------	------	------
210	Establishment of shipbuilding technology center		------		
211	Education of shipbuilding engineers		------	------	------
212	Domestic production of related industries		------	------	------

Figure 2.2 Implementation Program

Annex 2.1
MARINA REGISTERED SHIPBUILDERS/SHIPREPAIRERS

The shipbuilders/shiprepairers, include in the attached listings, are registered with the MARINA. This annex indicates their categories, the available facilities in their yards, the size and number of the vessels that these facilities can handle, at any one time, and the location of these facilities.

Following are the abbreviations of some of the facilities. As noted, the plants that can handle 3,000 GT vessels are classified under the Class "A" category; those that can handle 1,000 to 2,999 GT vessels are classified as Class "B", while those that can handle less than 1,000 GT vessels fall under the Class "C" category.

MS	Marine Slipway	FD	Floating Dock
SW	Shipbuilding Way	MR	Marine Railway
LD	Liftdock System	RB	Repair Berth
GD	Graving Dock	SL	Synchrolift

Source: Maritime Industry Authority (MARINA)

SYIPYRADS	CATEGPRU	FACILITY	SIZE/NUMBER	LOCATION
1. ABOITIZ ENGINEERING SERVICES CORP.	Ship Repairer (Afloat)	Machine Shop		McArthur Boulevard Cebu City
2. AGILAR MACHINE SHOP & MARINE WORKS, INC.	Ship Repairer (Afloat)	Machine Shop		Sta. Cruz, Manila
3. ASIACRAFT, INC	Shipbuilder	Machine Shop		Tanyag St. Bicutan, MM
4. ATLANTIC GULF AND PACIFIC CO. OF MANILA INC.	Shipbuilder & Ship Repairer	Railway Slipway Shipbuilding Way	-110 GT/4 -20,000 DWT/1 -20,000 DWT/1	Punta, Sta. Ana, Manila Mabini, Bauan, Bats
5. AQUADYNE SHIPYARDS, INC.	Shipbulider & Ship Repairer	Shipbuilding Way Shipbullding Way	-1,200 DWT/1 - 850 DWT/1	Navotas Manila
6. BATAAN SHIPYARD AND ENGINEERING CO., INC.	Shipbuilder & Ship Repairer	Graving Dock Sincrolift Marine Railway Marine Railway Marine Railway	-10,000 GT/1 - 3,000 GT/1 - 250 GT/1 - 1,500 GT/1 - 1,000 GT/1	Mariveles Bataan Port Area, Manila
7. BUENAVISTA DOCK AND SHIPBUILDING CO., INC.	Shipbuilder & Ship Repairer	Slipway	- 500 GT/1 - 1,000 GT/1	Jordan Buimaras Is Iloilo
8. CAPILITAN ENGINEERING CORPORATION	Ship Repairer (Afloat)	Machine Shop		Tondo, Manila
9. CEBU SHIPYARDS AND ENG'G WORKS, INC.	Shipbuilder & Ship Repairer	Slipway Shipbuilding Way Graving Dock	- 8,200 GT/5 - 3,000 GT/2 -20,000 GT/1	Lapu-Lapu City
10. COLORADO SHIPYARDS CORPORATION	Shipbulider & Ship Repairer	Slipway Slipway Slipway	- 3,000 GT/1 1,000 GT/1 600 GT/1	Tayud, Consolacion
11. DAVID SHIPYARD	Shipbuilder & Ship Repairer	Marine Railway Marine Railway	- 1,200 GT/1 - 800 GT/1	Tangos, Navotas
12. DESCO MARINE SHIPYARD.	Shipbulider & Ship Repairer	Shipbuilding Way	- 500 GT/1	Cadiz City
13. DMC SHIPBUILDERS, INC.	Shipbuilder & Ship Repairer	Slipway Shipbuilding Way	- 500 GT/1 - 1,200 GT/1	Racodo, Zamboanga

(Continued)

SYIPYRADS	CATEGPRU	FACILITY	SIZE/NUMBER	LOCATION
14. ENGINEERING EQUIPMENT, INC	Shipbulider & Ship Repairer	Railway Railway Railway Shipbuilding Way Slipway	- 2,500 GT/1 - 600 GT/1 - 250 GT/1 - 5,300 GT/5 - 800 GT/1	Bo, Sta. Maria Bauan, Batangas
15. E.E. MARINE CONSTRUCTION CORP.	Shipbuilder & Ship Repairer	Marine Railway Marine Railway Shipbuilding Way Slipway	- 300 GT/1 - 450 GT/2 - 400 GT/2 - 1,500 GT/3	Navotas, Manila
16. FILIPINAS FABRICATORS AND SALES, INC.	Ship Repairer (Afloat)	Machine Shop		35 Mercedes Arcade Bldg Highway, Mandaue City
17. FILIPINO SHIPYARDS & IRON WORKS, INC.	Shipbulider & Ship Repairer	Slipway Slipway Shipbuilding Way	- 1,200 GT/1 - 900 GT/1 - 1,200 GT/1	C. Valiente Bagong Ilog Pasig, Mla.
18. FLOATING MARINE AND REPAIR SERVICES, INC. (Inactive)	Shipbuilder & Ship Repairer	Machine Shop		Intramuros, Manila
19. FRABELLE SHIPYARD CORP.	Shipbulider & Ship Repairer	Slipway Slipway Marine Way	- 500 GT/1 - 200 GT/1 - 500 GT/2	Navotas, Manila
20. GUIMARAS DOCKS AND REPAIR WORKS, INC.	Shipbuilder & Ship Repairer	Slipway Slipway	- 400 GT/1 - 1,500 GT/1	Boro-Boro Bo, Dagsaan Guimaras Is
21. INLAND INDUSTRIAL AND CONSTRUCTION, INC.	Shipbulider & Ship Repairer	Slipway Slipway Shipbuilding Way	- 1,000 GT/2 - 200 GT/2 - 1,150 GT/2	Navotas, Manila
22. INTERMARINE, INC.	Shipbuilder & Ship Repairer	Machine Shop		Sta. Ana. Manila
23. J.E. PASCUAL SHIPBUILDERS, INC.	Shipbulider & Ship Repairer	Shipbuilding Way Shipbuilding Way Shipbuilding Way	- 2,000 DWT/1 - 1,000 DWT/1 - 1,150 GT/2	Navotas, Manila
24. J & H MARINE INDUSTRIAL CORP.	Shipbuilder & Ship Repairer	Machine Shop		Iloilo City
		Floating Dock	- 2,500 GT/1	Batangas

(Continued)

SYIPYRADS	CATEGPRU	FACILITY	SIZE/NUMBER	LOCATION
25. KEPPEL PHILS. SHIPYARD, INC. (KPSI)	Shipbulider & Ship Repairer	Floating Dock Floating Dock	- 2,100 GT/1 - 2,750 GT/1	Bo, Bolo Bauan,
26. LUZON SLIPWAYS AND SHIPBULDING CORP.	Shipbuilder & Ship Repairer	Slipway Shipbuilding Way Slipway	- 1,500 DWT/1 - 300 GT/1 - 500 GT/1	Navotas, Manila
27. MARCELO FIBERGLASS CORPORATION	Shipbulider & Ship Repairer	Building Berih Over Rail	- 50 GT/2 - 20 GT/2	Malabon, Manila
28. MATAMARINE ANCHORAGE SERVICES, INC.	Ship Repairer (Afloat)	Machine Shop		Marcos Road Opposite Pier 6, North Harbor, Manila
29. MASAYON MACHINE SHOP INC.	Ship Repairer (Afloat)	Machine Shop		Cebu City
30. MAYON DOCKS, INC.	Shipbulider & Ship Repairer	Slipway Slipway Slipway	- 2,000 GT/1 - 1,500 GT/4 - 850 GT/1	Barrio Salvacion Tabaco, Albay
31. METALOCK PHILS., INC. (Inactive)	Ship Repairer (Afloat)	Machine Shop		Cebu City
32. MINDANAO MARINE WORKS (Inactive)	Ship Repairer (Afloat)	Machine Shop		Davao City
33. NAUTILUS MARITIME VENTURES, INC. (Inactive)	Ship Repairer (Afloat)	Machine Shop		Navotas, Manila
34. NAVOTAS INDUSTRIAL CORPORATION	Shipbuilder & Ship Repairer	Slipway	- 6,500 DWT/1	Navotas, Manila
35. PACIFIC SEACRAFT (PHILS.) INC. (Inactive)	Shipbuilder & Ship Repairer	Machine Shop		Pasig, Manila
36. PADACO MARINE WORKS AND SHIPBUILDING	Shipbuilder & Ship Repairer	Shipbuilding Way	- 1,000 GT/1	Navotas, Manila
37. PHIL. IRON CONSTRUCTION & MARINE WORKS, INC.	Shipbuilder & Ship Repairer	Sincrolift Shipbuilding Way	- 3,000 DWT/1 - 3,000 DWT/1	Jasaan, Misamis

(Continued)

SYIPYRADS	CATEGPRU	FACILITY	SIZE/NUMBER	LOCATION
38. PNOC MARINE CORP.	Shipbuilder & Ship Repairer	Sincrolift Railway Shipbuilding Way Shipbuilding Way	- 7,500 GT/1 - 7,500 GT/1 -60,000 DWT/9 -36,200 LT/9	San Miguel Bauan, Batangas
39. PHILIPPINE SHIPYARD & ENGINEERING CORP. (PHILSECO)	Shipbuilder & Ship Repairer	Graving Dock	-300,000 DWT/1	Subic, Zambales
40. PKS SHIPYARD INC.	Ship Repairer	Graving Dock Shipbuilding Way	- 15 GT/1 - 850 GT/1	Cotabato City
41. PRECISION MARINE AND MACHINE WORKS, INC.	Ship Repairer (Afloat)	Machine Shop		Iloilo
42. RBL SHIPYARD CORP.	Ship Repairer	Marine Railway Marine Railway	- 1,200 GT/1 - 400 GT/1	Navotas, Manila
43. REPUBLIC DRYDOCK CORP.	Shipbuilder & Ship Repairer	Marine Railway Marine Railway	- 600 GT/3 - 1,200 GT/1	Danao City, Cebu
44. RNR MARINE, INC.	Ship Repairer	Machine Shop		Malabon, Manila
45. R. VISITACION & SONS	Ship Repairer	Shipbuilding Way	- 1,400 GT/1	Navotas, Manila
46. SANDOVAL SHIPYARD, INC.	Shipbuilder & Ship Repairer	Shipbuilding Way Shipbuilding Way Shipbuilding Way	- 600 GT/2 - 350 GT/2 - 4,450 GT/6	Navotas, Manila
47. S. POLICARPIO SHIPYARD & SHIPBUILDING CORP. (Inactive)	Shipbuilder & Ship Repairer	Shipbuilding Way Shipbuilding Way	- 2,000 GT/1 - 1,500 GT/1	Navotas, Manila
48. NATIONAL SLIPWAYS CORP. (formerly STA, MESA SLIPWAYS & ENG'G CO.)	Ship Repairer	Marine Railway Marine Railway	- 150 DWT/1 - 750 DWT/2	Sta. Mesa Manila
49. SULPICIO MACHINE SHOP INC.	Ship Repairer	Machine Shop		Cebu City
50. TANGOS SHIPYARD	Shipbuilder & Ship Repairer	Slipway	- 300 GT/2	Tangos, Navotas
51. TSI SHIP & YACHT BUILDERS, INC.	Shipbuilder & Ship Repairer	Machine Shop		Manila

(Continued)

SYIPYRADS	CATEGPRU	FACILITY	SIZE/NUMBER	LOCATION
52. V-BROS SHIPYARD CORP.	Shipbuilder & Ship Repairer	Graving Dock	- 200 GT/1	Negros Occidental
53. VADEO DOS SHIPYARD CORP.	Ship Repairer	Slipway	- 80 GT/1	Navotas, Manila
54. VARADERD DE RECODO	Ship Repairer	Slipway	- 1,100 GT/4	Racodo Zamboanga
55. VILLA REYES SHIP-BUILDING & SHIP REPAIR (Inactive)	Shipbuilder & Ship Repairer	Machine Shop		San Narciso Quezon
56. VISAYAS INDUSTRIAL & MARINE SERVICES	Ship Repairer (Afloat)	Machine Shop		Tondo, Manila
57. V.L. SHIPYARD CORP.	Shipbuilder & Ship Repairer	Slipway Slipway Building Berth Building Berth	- 400 GT/1 - 300 GT/1 - 1,000 DWT/1 - 80 GT/2	Navotas, Manila
58. V.Z. MARINE AND CONSTRUCTION, INC.	Ship Repairer (Afloat)	Machine Shop		Cavite City
59. WESTERN SHIPYARD SERVICES, INC.	Shipbuilder & Ship Repairer	Slipway	- 1,000 GT/2	Navotas, Manila
60. WESTERN VISAYAS SHIP-BUILDERS & REPAIR CO., INC.	Ship Repairer	Machine Shop Slipway Slipway	 - 600 DWT/1 - 300 DWT/1	Malabon, Manila c/o RJL Bldg. Muelle Loney, Zamora St. Iloilo City
61. WILINES MARITIME SERVICES, INC.	Ship Repairer (Afloat)	Machine Shop		H. Joaquino Street Mabolo, Cebu City
62. YRASPORT DRYDOCK CO., INC.	Shipbuilder & Ship Repairer	Slipway	- 1,000 GT/2	Mandaue City
63. ZEAGUD MARINE CORP.	Shipbuilder & Ship Repairer	Shipbuilding Way	- 2,999 GT/1	Navotas, Manila

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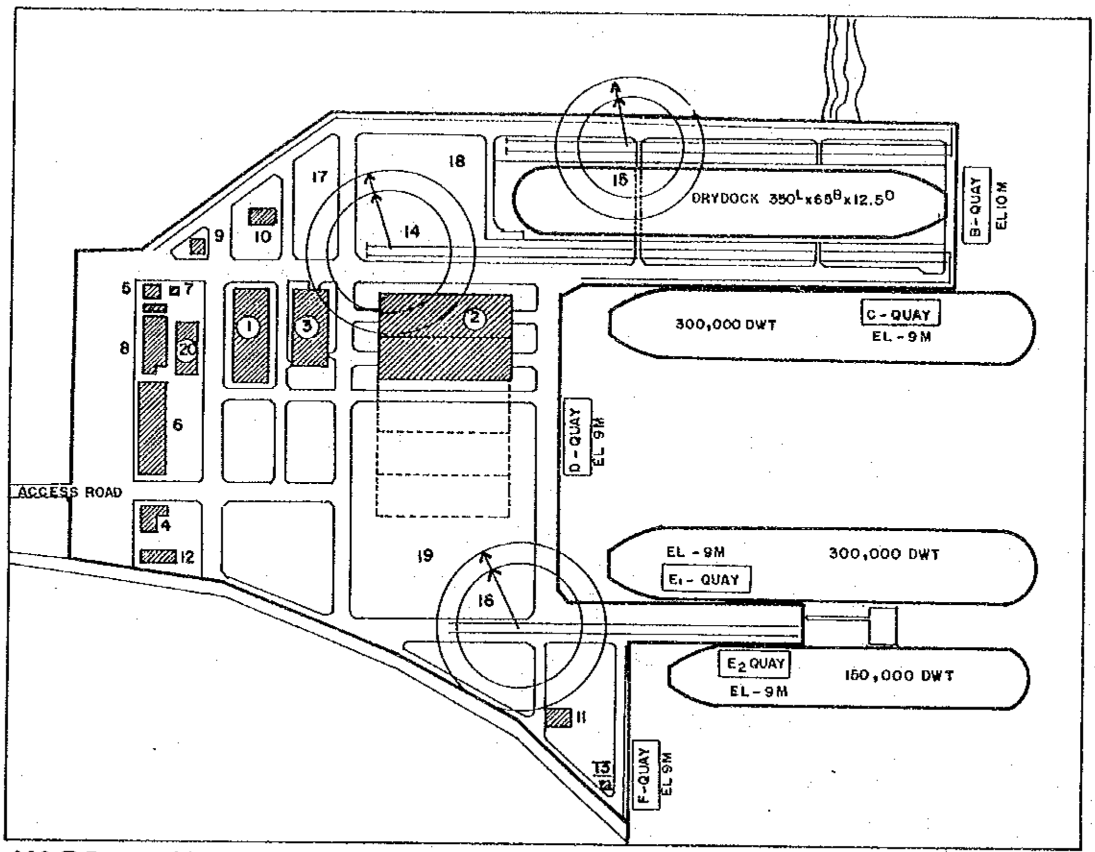
Annex 2.2
Philippine Shipyard and Engineering Corporation
(PHILSECO)



YARD LAYOUT

LEGEND:

1. Administration Office & Training Center
2. Repairshop
3. Warehouse
4. Gate House & Dispensary
5. Gatehouse
6. Main Substation
7. Oxygen Storage
8. Water Reservoir & Pump Room
9. Acetylene Storage
10. Compressor Room
11. Painting Storage
12. Waste Water Treatment Plant
13. Incinerator
14. 80T Jib Crane
15. 30T Jib Crane
16. 15T Jib Crane
17. Material Yard
18. Erection Yard
19. Equipment Yard
20. Canteen

MAIN FACILITIES

A 300,000 DWT capacity graving dock (350 mL × 65 mW × 12.5 mD) with an intermediate gate which is 110 meters from the dockhead.

Three repair berths with a total mooring length of 620 meters.

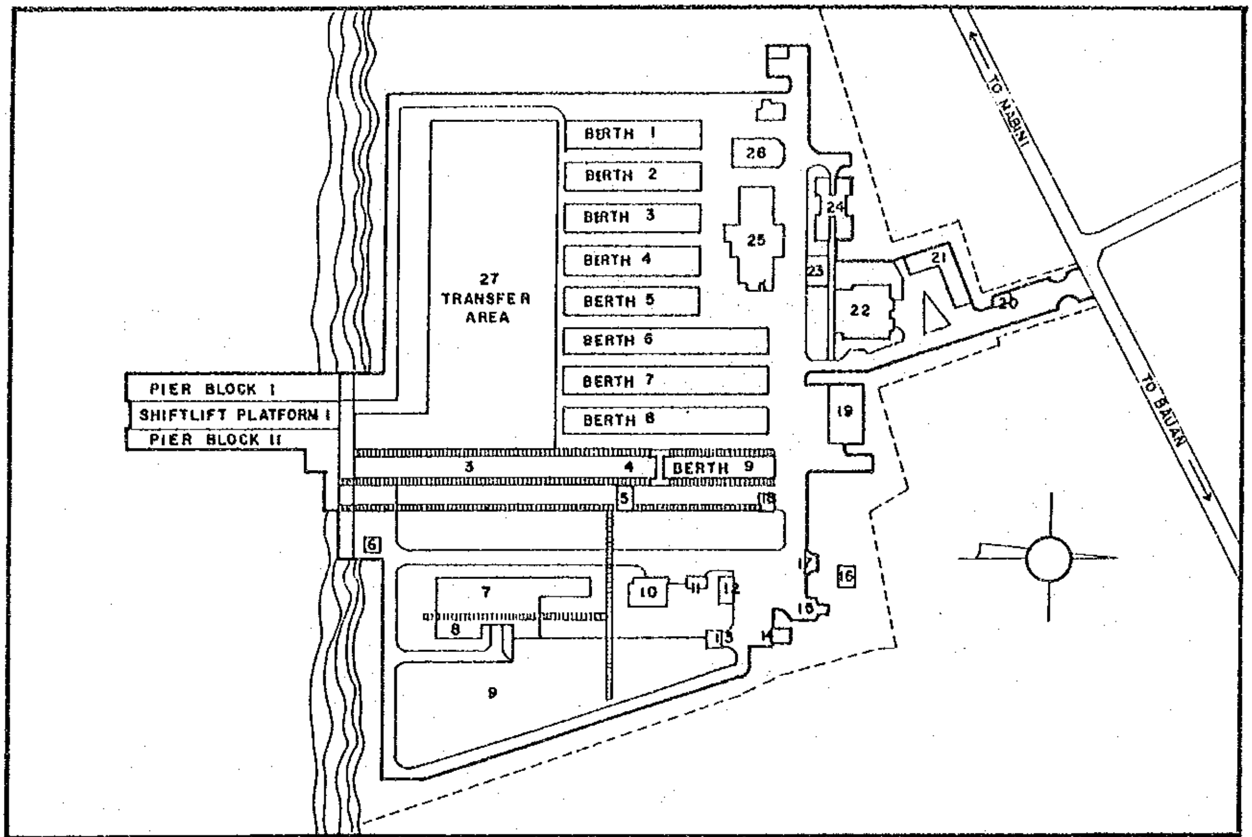
Excellent craneage, consisting of 15-ton, 30-ton and 80-ton travelling jib cranes, is provided to the dock and quays.

The yard maintains its own fleet of tugs.

The main repair shop houses various shops for hull and machinery works.

Fresh and ballast water, compressed air, oxygen, electric power, telecommunications and fire system networks are well provided.

Annex 2.3
PNOC Dockyard and Engineering Corporation



1 Shiplift (20,000 DWT capacity); 2 Liftcontrol building; 3 New construction/ erection area; 4 Gantry crane (50 tons capacity); 5 Whirley crane (42 tons capacity); 6 Receiving and control building; 7 Covered fabrication area; 8 Steel fabrication shop; 9 Open storage; 10 Carpentry shop and mold fit; 11 Vehicle-repair shop; 12 Power plant; 13 Propane-storage pad; 14 Flammable storage; 15 Oxygen plant; 15 Water-storage tank; 17 Pump house; 18 Crane control house; 19 Warehouse; 20 Gate and control building; 21 Parking area; 22 Administrative/clinic building; 23 Employee service; 24 Canteen; 25 Outfitting shop; 26 Piping storage; 27 Transfer area.

Shiplift Drydock

Lifting capacity .... up to 20,000 DWT or 7,500 LT (light displacement weight)
Platform length .... 172.5 meters
Platform width ..... 28.0 meters
Depth/draft .... 8.0 meters
Elevation of pier ..... 4.6 meters

Eight Repair Berths

a BERTHS 1-6
Capacity .... up to 4,000 deadweight tons
Length .... 105.0 meters
Width .... 20.0 meters

b BERTH 7
Capacity .... up to 10,000 deadweight tons
Length .... 108.0 meters
Width .... 27.0 meters

c BERTH 8
Capacity .... up to 20,000 DWT
Length .... 172.0 meters
Width .... 27.0 meters

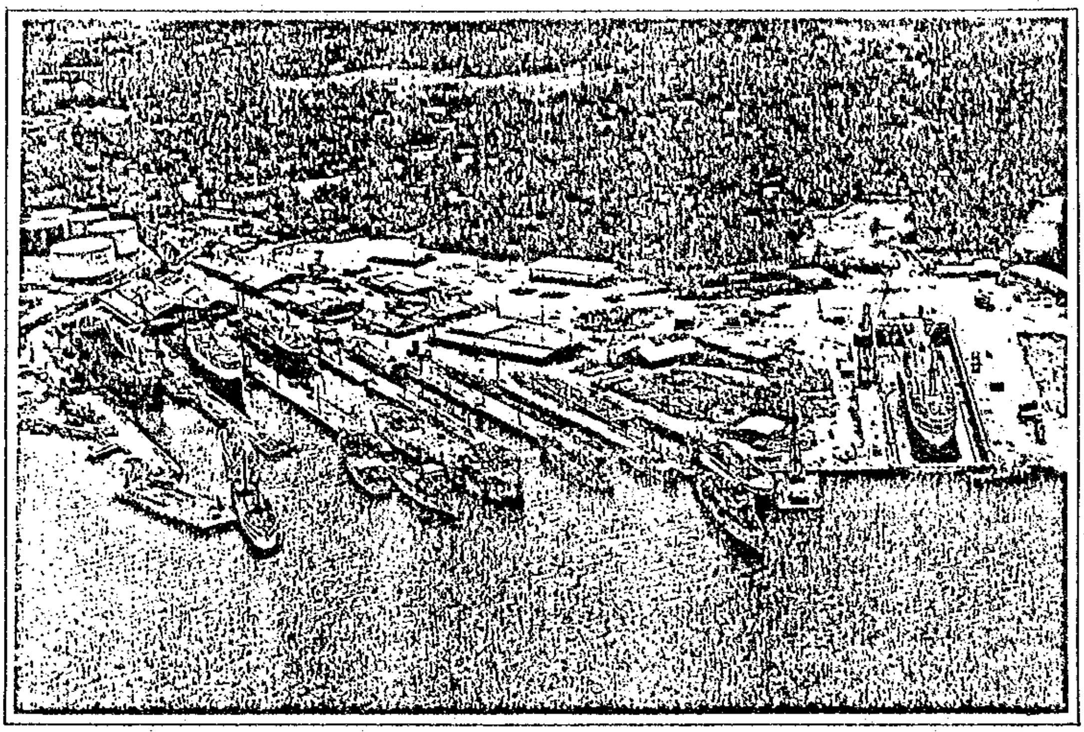
New Construction Berth 9

Capacity .... up to 20,000 DWT or 7,500 LT (light displacement weight)
Length .... 167.0 meters
Width .... 27.0 meters

Berthage: Total of almost 425 meters consisting of:
Pier I .... 182.9 meters
Pier II .... 160.0 meters
Pier III .... 82.0 meters
Depth ....12.0 meters

Annex 2.4

Cebu Shipyard and Engineering Corporation



Facilities

CSEW's yard occupies an area of 150,000 square meters. Its facilities include a drydock, six slipways, extensive cranage and ample berthing space.

Drydock

Capacity	—	20,000 dwt (can be upgraded to 60,000 dwt)
Length	—	160 meters
Width	—	30 meters
Pumps	—	rated discharge time is three to four hours
Cranage	—	"OBE" Jib Crane Rope Balance Type Level Luffing 20t x 24m; 8t x 35m located at the portside
Others	—	Two 634 CFM 100 psi air compressors; pipelines along the side for oxygen, acetylene, fresh water, compressed air, sea water and electrical lines; stationery keel blocks and mechanically operated bilge blocks.

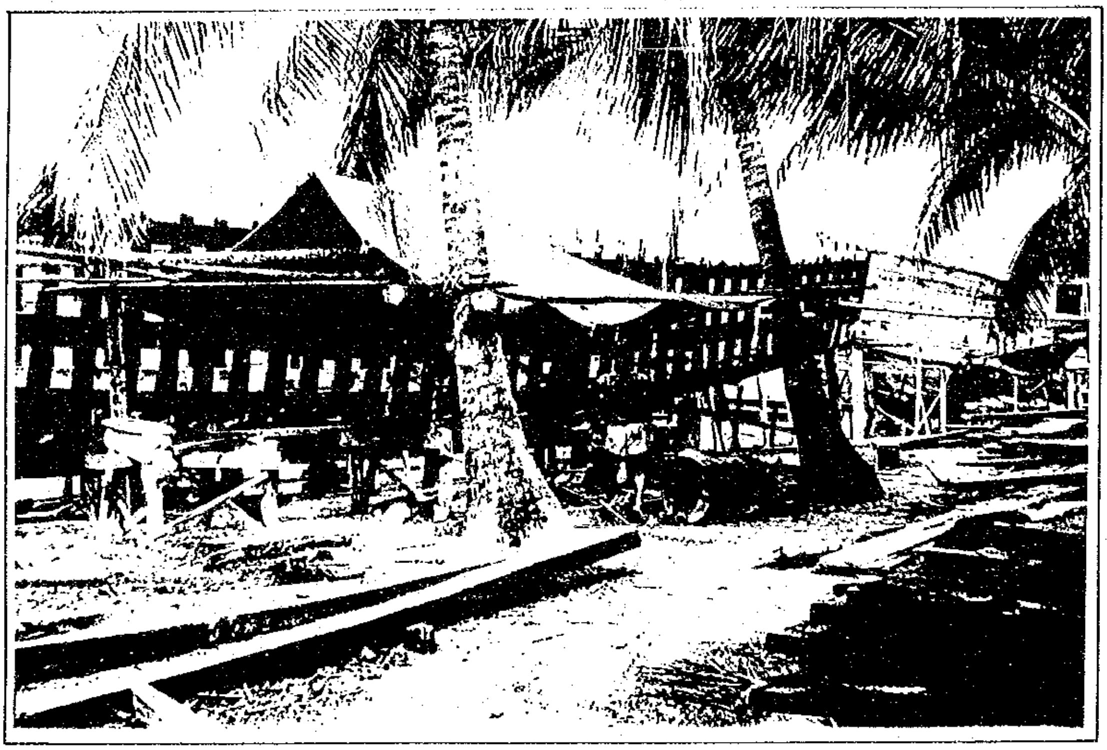
Slipways

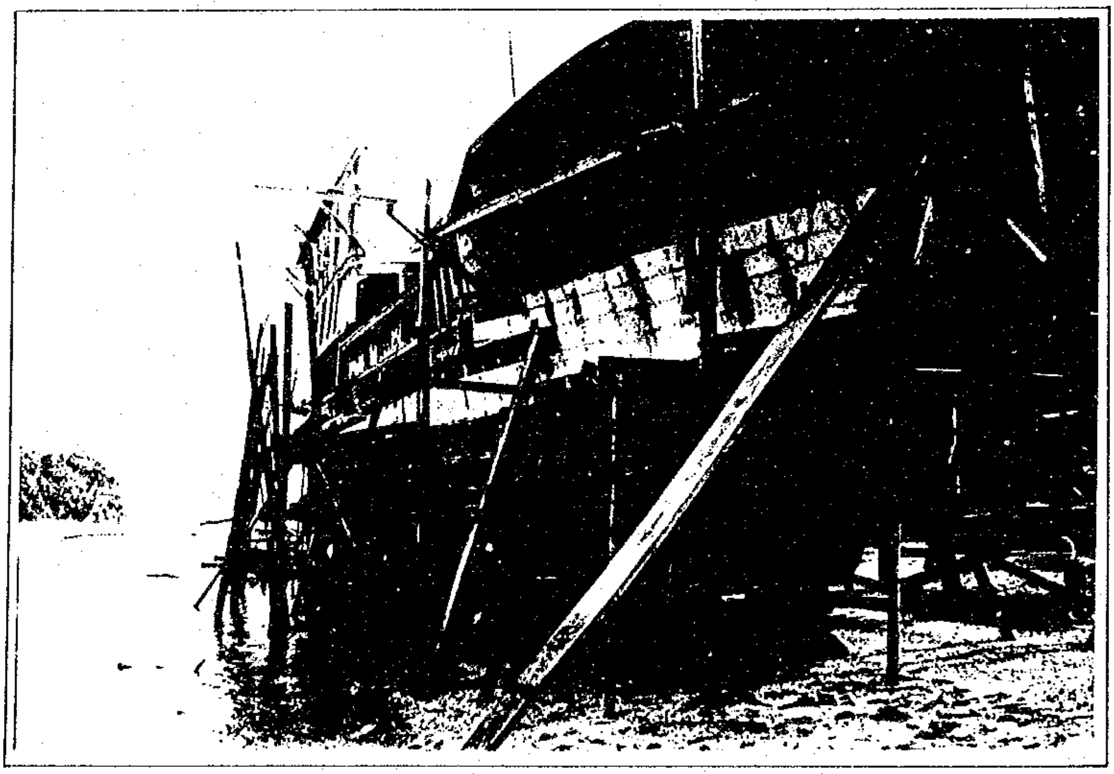
	Capacity (Lightship in tonnes)	Dimensions (metres)
Slipway No. 6	4000	105 x 10.4
Slipway No. 1	2000	79 x 7
Slipway No. 2	1000	73 x 7.9
Slipway No. 3	800	43 x 3.1
Slipway No. 4	400	43 x 3.1
End Launching Way	2000 GRT	64 x 5.2
Side Launching Way	1000 GRT	47 x LBP

Craneage

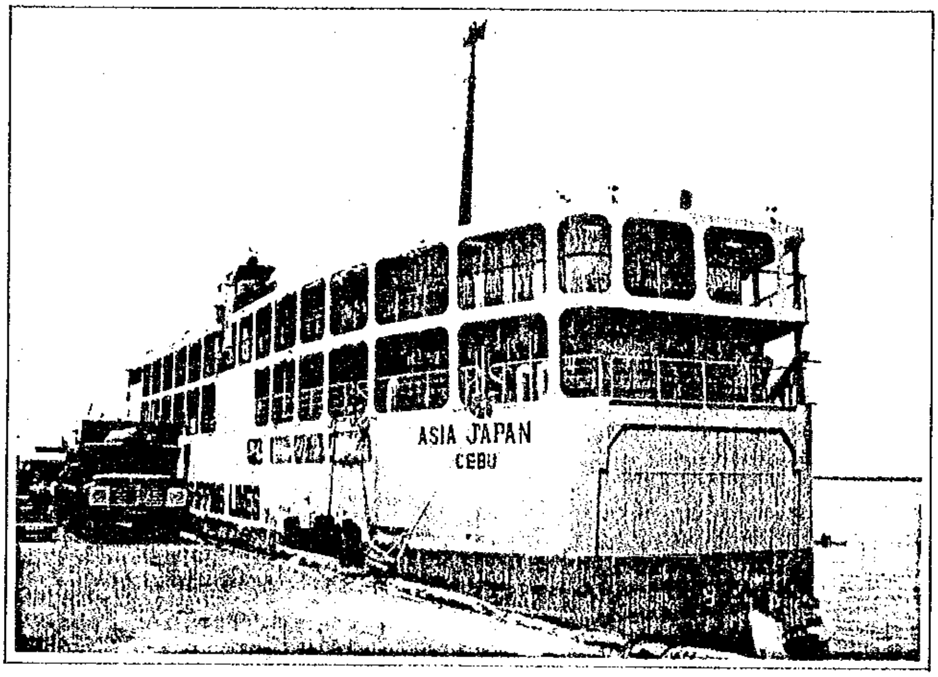
50 tons	—	Crawler crane
25 tons	—	Truck-mounted crane
25 tons	—	Crawler crane
20 tons	—	Truck-mounted crane
7 tons	—	Truck-mounted crane
5 tons	—	Travelling jib crane
3 tons	—	Hoist crane

Annex 2.5
Local Shipyards at Seaside
(Photograph)



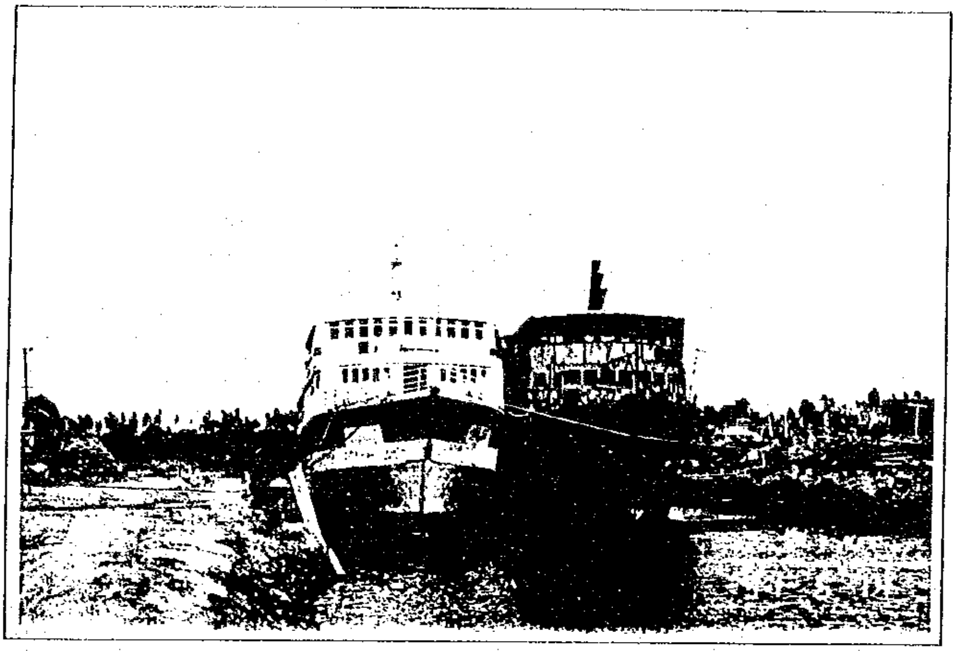


Annex 2.6
Examples of Conversion
(Photograph)



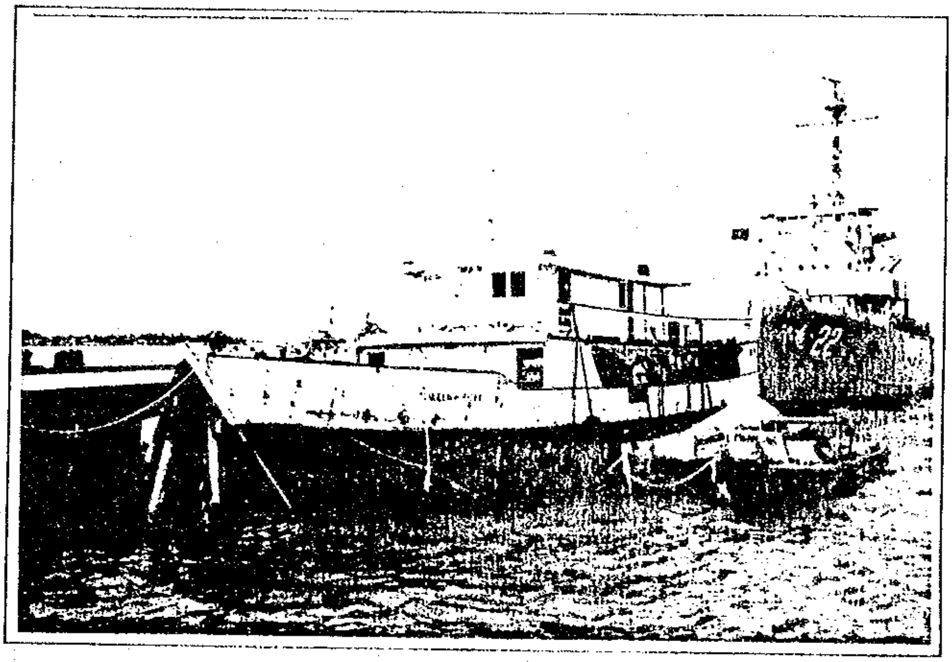
Installing more decks to increase the capacity is common.

Annex 2.7
An Example of Less Stable Ship
(Photograph)



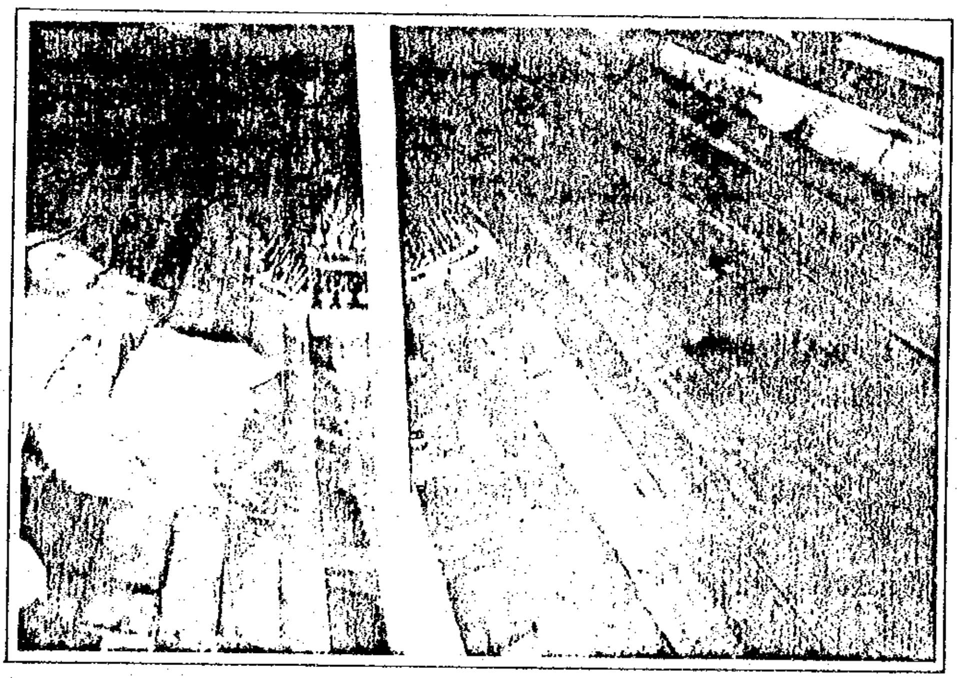
The vessel on the right side is a fishing boat being converted to passenger boat. Less stability caused by conversion is easily noted.

Annex 2.8
An Example of Ship Without Bulkhead
(Photograph)

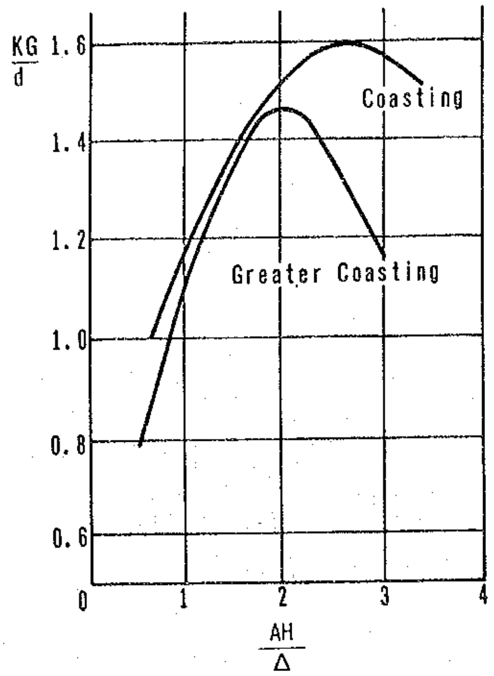


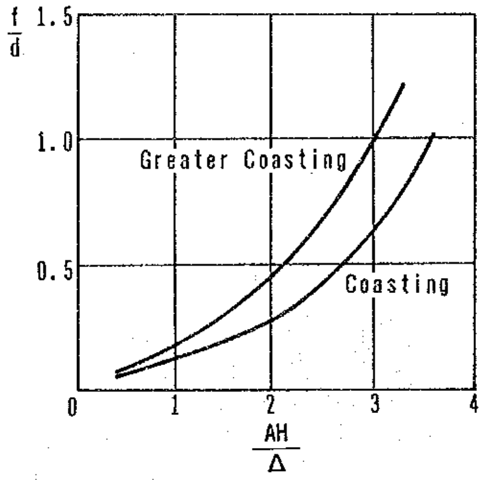
Above is a full view of a wooden hull passenger cargo.

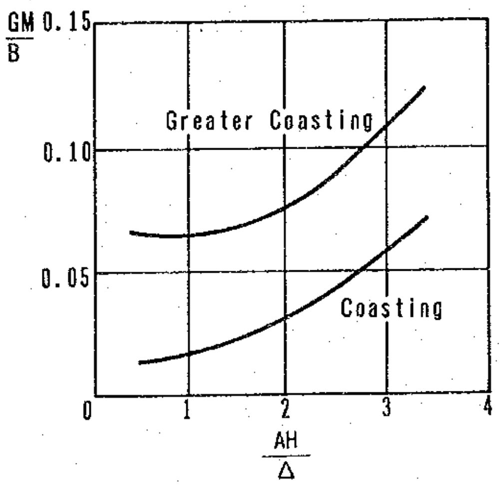
Below is the cargo hold of the above vessel. Engine room is separated from the cargo hold by a wall which is not watertight. No collision bulkhead is seen.



Annex 2.9
SIMPLE JUDGING METHOD OF STABILITY OF VESSELS







A : Projected lateral area of the ship above waterline (m^2)

H : Vertical height between the center of "A" and the center of underwater projected lateral area of hull (m)

In general,the center of underwater projected lateral area may be approximated to locate at half the draft.

Δ : Displacement (ton)

KG : The center of gravity above baseline (m)

GM : Metacentric height (m)

f : Freeboat of the ship (m)

d : Mean draft of the ship (m)

B : Moulded breadth of the ship (m)

3. AIDS TO NAVIGATION

The aids to navigation, irrespective of countries where they are established, are common to mariners, and are concerned with the international harmonization in system and the same cooperation and coordination in operation.

The International Association of Lighthouse Authorities (IALA) has been working in such fields for the benefit of aids to navigation authorities, and issued in 1990 "IALA Aids to navigation Guide (NAVGUIDE)".

It is remarked with gratitude to IALA that a number of references and quotes are made in this study to and from it.

3.1 Present Status of Aids to Navigation

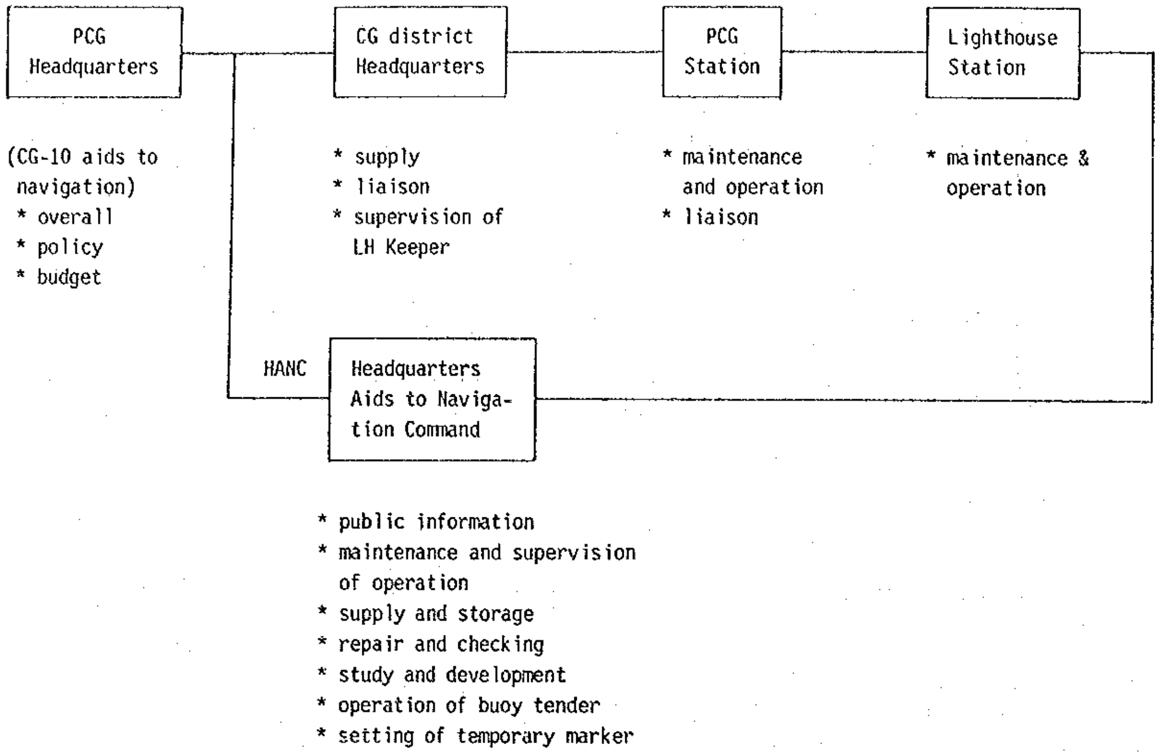
3.1.1 Existing Organization Set-up for Aids to Navigation

The Philippine Coast Guard (PCG) is the sole authority regarding the management of aids to navigation in accordance with Republic Act 5173. The PCG carries out the operation and maintenance of navaids under the functions of safety of navigation.

This has been centralized under the Aids to Navigation Command (ANC) since 1974. In April 1987, the PCG issued a circular decentralizing the administration and supervision of navaids, in effect transferring such functions to the 8 PCG district command. Apparently, this move was meant to increase the efficiency of the various stations. ANC was left but three functions; conducting major repairs, and improvement, research and development and training.

However, due to the lack of skilled personnel in the distinct commands, ANC up to now continues to undertake its original functions.

The present PCG internal organization which is in charge of aids to navigation is, as follows:



The above chart shows that the administrative section in charge of aids to navigation in the PCG is the CG-10, while the Headquarters of the Aids to Navigation Command of HANC, a unit of PCG, is in charge of field technical operations. The number of personnel in HANC are, as follows:

Officer	4
Enlisted	38
Civilian Employees	6
Lightkeeper	353

By virtue of Memorandum-Circular Number 04-09 which provides guidelines on the establishment of Aids to navigation in the Philippines, aids to navigation boards have been created, namely, the National Board for aids to navigation (NABAN) and the district Board for Aids to navigation (DIBAN), at the coast guard district level.

NABAN is an inter-agency grouping composed of representation from PCG (CG-10), DOTC, MARINA, PPA, NAMRIA, representing the government sector, and CISO, PISA, FPAP representing the private sector, with the Deputy Commandant, PCG as Chairman. Essentially, it will evaluate aids to navigation facilities for establishment, repair and/or rehabilitation, oversee the establishment and development of the Vessel Traffic system (VTS), formulate policies regarding light dues, and submit recommendation to PCG, for approval.

DIBAN, on the other hand, is composed of all station commanders in the district as members, with representatives, also, from the PA, CISO, FPAP, the Harbour Pilot Association, etc. with the CG District Commander as Chairman. DIBAN is tasked to prepare a priority list of lighthouses, beacons and buoyes for repair/rehabilitation, develop the VTS, prepare a list of logistical requirements within its AOR and submit recommendation to NABAN.

The Department of Transportation and Communication (DOTC), on the other hand, is the government entity the provides the funds for the technical supervision of the repair, rehabilitation and construction of the lighthouse structures, buoys and other maritime navigational aids. This was previously under the jurisdiction of the Department of Public Works and Highways (DPWH), but upon the recommendation of the report of the task force, on interisland shipping industry, the transfer took effect.

There are a number of important problems to be looked into, however, before this order is implemented, involving such matters as budget, personnel, etc. so far, the matter has remained in the status quo.

Within harbour units, navigational aids may be provided by the Philippine Ports Authority (PPA) under port development contracts. The maintenance and operation of these navaids, however, are invariably delegated to the PCG.

3.1.2 Present Condition of Aids to Navigation

With respect to its 18,000 NM coastline, the Philippines has a total of 333 light stations, consisting of lighthouses and beacons. Of these 279 are operational while 54 are non-operational (DOTC, PCG data). On the other hand, total number of buoys as reported by the PCB CG-10D are 40, broken down into 14 lighted and 26 unlighted.

As of April 30, 1991

Lighthouses and beacons	Operational	279
	Non-operational	54
	Total	333
Buoys	Lighted	14
	Un-lighted	26
	Total	40
	Grand Total	373

The visible ranges of lighthouses/beacons vary from over 20 miles in case of primary lighthouses to less than 20 miles for secondary ones and less than 10 miles for tertiary lightbeacons. Some lighthouses use large-scale rotary lighting devices installed between 1975 and 1977 when rehabilitation of the facilities was made by England. Energy is supplied by means of diesel engines, commercial electricity, battery and solar panels and some units that till make use of kerosene lamps.

Although, the position or location of navaids is suitable, the operation rate of existing navaids is low and light sources are generally weak. the actual visible range of some lighthouses is insufficient and significant reduce in view of decreased luminosity. Even if individual checking could not be made, by estimation, the number of inoperable lighthouses and lighthouses with low visible range could probably reduce the total coverage to a considerably low optimum.

3.1.3 Maintenance Scheme

PCG has five (5) buoy-tender ships that are utilized for maintenance and repair of lighthouse through out the Philippines namely AE45, AE46, AG89, AE59 and AE79. Except for AE45 and AE89 which have not been functioning, all other ships are ready for sea and deployed in the area at present. Aside from the above mentioned vessels the PCG is also tapping PHILFLT ships e.g. AT-71 or other vessels that are available since AT-71 has the same mission and capabilities.

PCG stations have small ships such as motor banca for maintenance and checking, but there are no skilled personnel/technician who can do the repairs and/or conduct preventive maintenance. some lighthouses are maintained by lighthouse keepers who stay there for 2 weeks, while other go, alternately. 189 ATNs of a total of 333 are manned stations.

However, these manned stations do not function as reported. The main reason is the housing inadequacy of lighthouse keepers who live in old, dilapidated houses.

Work assignment for lighthouse keepers is not also clearly defined. They are, de facto, to light on/off (in some stations it is done automatically), to operate a generator, to charge batteries and to manage facilities.

Private sector transportation system is sometimes available for inspection especially in cases of emergency. But this seldom happens in vie of financial constraints.

Procurement of spare parts has been very slow. Delays in funding traveling expenses hinder the timely sending of maintenance teams.

In 1988, about 3.0 M Pesos has been earmarked by the government for maintenance and operation of aids to navigation and an additional special budget of 51.2 million pesos has been allocated to the PCG for the rehabilitation and repair work of major lighthouses (1988). However, total improvements have not been undertaken since most of the spare and maintenance parts imputed need enormous amount of money.

Table 3.1
Maintenance and Operation (except personnel cost)
unit: thousand pesos

Year	1984	1985	1986	1987	1988	1989	1990
Facilities (PCG)	100	3,428 332	774	1,500	51,210 4,125	102,000 4,897	3,000
Structures (DOTC)	0	0	0	4,170	4,609	5,232	25,000
Repair of Buoy tender (OCG)	1,600	700	750	1,800	700	5,000	5,000

In 1985, 1988 and 1989 special budget allocation was given to the the PCG for rehabilitation of aids to navigation facilities. The allocation for 1988 at 51.2 M Pesos, as mentioned above, was used to repair and modernize 72 lighthouses and beacons nationwide from january 1 - October 15, 1989. These were located mostly in the primary routes covering sea-lanes of dense maritime traffic in the Visayas, Manila Bay, Fernando, Southern Tagalog and Batangas.

In 1990, the cost for structure increased 5 times compared to the previous year as a result of the transfer of budget authority form the DPWH to DOTC. DOTC, this time ranked maintenance, improvement and rehabilitation of aids to navigation facilities as a high priority. a result of this was DOTC and PCG's stepped-up efforts in rehabilitating ATNs that are inoperable. This increased the number of ATNs in operation from 210 to 319 in the recent several years. Rehabilitation, however, was done immediately as an emergency measure. Therefore, all lighthouses and lightbeacons were rehabilitated using the same standard, 300 mm lantern powered with solar panel. This move resulted in the shortage of lighting power on the important/large primary lighthouses and Lightbeacons. At present, around 25 lighthouses and lightbeacons that are not operating need reconstruction of their towers.

DOTC has earmarked at this point the repair of 120 units of aids to navigation facilities. The PCG on the other hand, has requested the DOTC for realignment, trimming the 12 units to 25 light stations. Also, for CY 1991, the PCG has programmed the repair and/or rehabilitation of 28 light stations along the Manila-Cebu route under the OECF improvement program.

3.1.4 List of Visual Aids

The list of lighthouses/beacons by C.G.District, type and status is shown in Table 3.2.

Table 3.2
List of Lighthouses and Beacons by Region
(as of 21 August, 1991)

C.G.District	No. of Lighthouses & Beacons			Sub-	Status	
	Primary	Secondary	Tertiary	Total	O	N
1	7	4	18	29	26	3
2	14	25	57	96	82	14
3	5	3	14	22	21	1
4	6	8	5	19	14	5
5	15	20	63	98	78	20
6	7	6	10	23	21	2
7	12	5	10	27	25	2
8	5	4	10	19	12	7
Total	71	75	187	333	279	54

Note: Status O = Operational, N = Non Operational
as of August, 1991

The station are classified by type (i.e., primary, secondary and tertiary defined) as follows:

* Primary - landfall lights; visibility should be greater than 20 nautical miles

* Secondary - Coastal light; visibility should be about 10 nautical miles

* Tertiary - port lights; visibility less than 10 nautical miles

3.1.5 Results of the On-sight Investigation

The damages to lighthouse and lightbeacons investigated vary according to local conditions and types of structured materials, and therefore, general solutions to the problem are difficult to apply.

Only a limited area is covered in the on-sight investigation. (Refer to Investigation of Aids to Navigation in Data Report)

3.2 Policy Consideration for Development

For planning new aids a number of national circumstances should be considered while the international cooperation is obvious.

The establishment of visual aids to navigation will influence the eaters of the own jurisdiction, while that of a long range radio aids will in many cases do those of more than one national.

3.2.1 Planning Consideration

(1) Geographical areas and service coverages

The geographical areas contemplated are the entire waters of the Philippines placing an emphasis on the main traffic routes for establishments of navaids.

(2) Type of aids contemplated

Both the visual and electronic aids to navigation should be contemplated; the visual aids consist of lighthouses, light beacons and floating lights and the electronic aids comprise a long range radio aids. radar aids and local weather information broadcasting system.

The supporting systems should also be planned in conformity with the navaids development.

3.2.2 Types of Aids to Navigation Contemplated and Economic Factors

The types of aids to be contemplated for establishment are the visual and radar aids in higher priority and the long range radio aid to be followed for cost effectiveness and navigation efficiency.

The local weather information broadcasting system will be introduced to enhance securing navigation safety.

In formulating new development plan, the following major area should be considered for effectuation of cost savings on a long term basis:

(1) Rehabilitation of existing aids

The lighthouses and other lights existing are located at the right locations. There are, however, a number of the existing lights need to be improved and rehabilitated due to their poor light facilities, low luminous range, tear and wear of associated facilities, shortage of spare supplies and the like. The improvement and rehabilitation for such lights are 'must' to secure the navigation safety.

The implementation priority for such improvement and rehabilitation should be planned together with the development plan for new aids to navigation. In the insufficient rate of light availability in Philippine waters, a realistic approach of the simultaneous implementation of both the new development and the improvement and rehabilitation is considered most appropriate.

(2) Optimum mix of aids

Proper mix of visual and radio aids should be provided bearing in mind the traffic being catered for but without waste.

Such an in-built tendency situations should be duly overcome as for local people to often resist the discontinuance of aids irrespective of need of the radical changes to be made necessary.

The mariner's needs should be considered in consultation with all interested parties to ensure that navigation can be carried out with the accuracy required and that dangers can be avoided in a cost effective way.

(3) Manning levels

The inadequacy of present manning levels is obvious for the maintenance and operation of aids to navigation.

The introduction of reliable automatic equipment may lighten strains of the necessity for increase in navaids personnel at the time of new development and rehabilitation.

(4) Maintenance procedures

Cost saving in maintenance may be achieved, among others, by:

- use of natural energy source like solar panels
- introduction of modern and well proven materials requiring little or no maintenance attention
- application of simple and reliable design and components

3.2.3 Route/User Identification

The important maritime routes are the domestic liner routes, which are classified as given below:

(1) Primary route

This has national significance in transportation of domestic passengers and freight volume.

The route has relatively high volume demand and links major ports and serves the main population of the country and commercial and industrial centers.

(2) Secondary route

This has regional significance in transportation of domestic passengers and freight volume.

The route has a sizable volume demand and links main gravitational centers of regional or inter-regional systems.

(3) Tertiary route

This is considered a feeder route for domestic passengers and cargo traffic destined between the major ports and various small ports along the routes.

3.2.4 System Consideration in terms of User and Provider

A mariner will use one or more navaid systems, wherever available, for his navigation safety depending on his circumstance. He may conceivably use visual and radar aids when he is close to the coast. If, however, the visibility reduces he will probably use radar aids as his preferred system with the possibility that he confirms his position with a radio navigation system.

There are various type of aids to navigation, and they have advantages as well as disadvantages for the user and for the provider which are given in Table 3.3.

3.2.5 Navigation Requirements/Phase of Navigation

The navigation requirements are divided into the phase of navigation shown below together with the navigation aid systems applicable:

Phase of Navigation	Description	Navaids Applicable
(1) Ocean Navigation	Navigation beyond a continental shelf and/or more than 50 n.m. from land or other obstructions	Radio aids
(2) Coastal Navigation	Navigation within 50 n.m. from land or within the outer limit of offshore shoals or other hazards, or where navigation is subject to restrictions	Visual aids Radio aids Radar aids
(3) Harbour Approaches & Harbour Navigation	In general, waters inland from those of the coastal phase. This has to be defined individually for each waterway	Visual aids Radio aids Radar aids
(4) Inland Water Navigation	Navigation in restricted areas similar to those for harbours or harbour approaches	Visual aids Radar aids

Table 3.3
Aids to Navigation System Mix

The various type of aids to navigation have advantages and disadvantages for the user as well as for the provider as indicated in the table below.

Type of Aid	Users		Providers	
	Advantages	Disadvantages	Advantages	Disadvantages
Visual	- Can be used to position - Convey immediate info - Can be used without a chart if user have a good local knowledge	- Range depends on site, height, colour, background - Limited by visibility - Position of aids not always accurate	- For hazard warning, traffic regulation, guidance, etc. - Placement flexible - Maintenance requires little training	- Maintenance expencive - Planning for maintenance depends on weather conditions - Logistic system required - Training maintenance personnel
Radar	- Identification with racon possible in reduced visibility conditions - With a racon identification of low coastline - Only one Aid required - Rapid deployment	- On board equipment needed - Racons may interfere - If not placed in an appropriate configuration, aids equipped with radar reflector are difficult to identify	- Can replace visual aids - Warnings of dangers (New Dangers)	- Radar reflectors needed - Some vessels do not have radar - Racon investment expensive - Training maintenance of racons
Radio	- Widescale coverage - All weather use - Automatic navigation - Precision possible	- On board equipment needed	- Reduced maintenance - Automatic monitoring - Reduction of visual aids possible	- May not be under Lighthouse Authority control - Monitoring requirement - Training maintenance personnel - Large investment

3.3 Assessment of the Need for Aids to Navigation and Basic Requirements for system and Equipment

3.3.1 Assessment of the Need for Aids to Navigation

The assessment of the need for aids to navigation should be made from the view point of the user combined with that of the provider in terms of usability and cost effectiveness.

The functions of visual and radar aids can be divided into four categories but they often perform more than one of the functions:

a. Position fixing
b. Hazard warning
c. Confirmation of a position derived from another system
d. Indication of traffic arrangement by laws and regulations

The functions of radio aids have only two:

a. Position fixing
b. Confirmation of a position derived from another system

The aids to navigation system or mix or systems should implemented primarily according to the assessment basis given in Table 3.4.

Table 3.4
Assessment Basis for Aids to Navigation

Aids	Phase	Type		Primary	Secondary	Tertiary	Development
VISUAL AIDS	Ocean	Lighthouse		Visible unit:min.1	Visible unit:min.1		
		Light Beacon		Visible unit:min.1	Visible unit:min.1		
	Coastal	Lighthouse		P - F	P - F	A - B	A - B
		Light Beacon	L	P - F	P - F	A - B	A - B
			M	P - F	P - F	A - B	A - B
	Harbour approach & navigation	Light Beacon	M	A - B	A - B	A - B	A - B
			S	A - B	A - B	A - B	A - B
		RLB		A - B	A - B	A - B	A - B
		Light buoy		A - B	A - B	A - B	A - B
ELECTRONIC AIDS	Ocean	Long Range Radio Aids		P - F	P - F	P - F	P - F
		Radar Aids		A - B	A - B		
		Local weather info broadcast		B - C	B - C		
	Coastal	Long Range Radio Aids		P - F	P - F	P - F	P - F
		Radar Aids		A - B	A - B		
		Local weather info broadcast		B - C	B - C		
	Harbour approach & navigation	Long Range Radio Aids		P - F	P - F	P - F	P - F
		Radar Aids		A - B	A - B	A - B	A - B
		Local weather info broadcast		B - C	B - C		

- Remarks -

Visible unit: min. 1   At least one unit of lights should be sighted in major costal areas under normal conditions

P-F : Position fixing
A-B : Accurate bearing
B-C : Within the broadcasting service coverages

3.3.2 Basic Requirement for System an Equipment

(1) Standardization

In the past when aids to navigation authorities decided that it was necessary to establish a lighthouse in a certain position they usually installed the most powerful light available. This has resulted in a situation where many authorities have to maintain a variety of different types of equipment at the stations under their control.

Electronic position fixing systems, and the receivers required to use the systems, are becoming more accurate and reliable. Also with the increased use of racons as aids to navigation authorities modernize and automate their equipment, they are now able to install less powerful lights.

One of the main advantages of automation is the economies following the reduction in manpower. consideration of standardization of equipment can also lead to economic benefits.

The benefits of standardization can be summarized as follows:

- fewer different types of equipment in use means that fewer maintenance personnel are required.

- less spares need to be stored leading to:

  a. Less space being utilized for spares reducing rents or releasing space for more productive use.

  b. Less capital being tied up as an investment in spares.

- it can lead to better liaison between authorities and manufactures of equipment and may lead to economies through larger orders of certain types of equipment.

- it allows greater flexibility and certainty in the replacement of parts on stations. This coupled with the greater familiarity of technicians with the equipment can lead to less downtime following a failure of an aid to navigation.

One factor that authorities may consider is standardization not just of types of equipment but also in the ranges of the aids to be established. When considering the establishment of a new or modification of an existing aid an authority may for example determine that a light with a nominal range of 12 n. miles is required.

(2) Light monitoring system

Light buoys and lights are installed in the waters of important traffic to indicate navigable waters, turning points and locations of navigational dangers for the safety of sea transportation and promotion of the navigation efficiency. And malfunctions or troubles of navaids could lead to serious incidents in busy traffic areas such as in-port, port entrance and surrounding areas. The monitoring of lights in such waters significantly improve the operational reliability of aids, thus lead to safe navigation.

In order to accomplish the ultimate purpose of navigation for ships, the light monitoring system is planned for:

a. monitoring of operational function of lights
b. quick recovery of lights in case of trouble or failure

The monitoring of lights may be carried out either visually or electronically. Visual monitoring of lights can be by light watchers, and the watching will be on a basis of certain time intervals to be reported to navaids base or unit. This visual method could be unreliable due to involvement of a defect of human factor. Electronic monitoring has high reliability, but needs the initial investment, which may be minimal from the overall economy point of view in comparison to the vast risk and loss in property and human life to possibly occur in case of marine accident.

The establishment of electronic light monitoring system is in general practice for important and busy traffic area. The system configuration of electronic light monitoring system is as shown in Figure 3.1. The buoy in short range group are monitored directly through VHF, those in medium range and long range groups are monitored via a radio relay station through VHF/UHF radio links. Each buoy within the several coverage is equipped with transmitter/receiver on board, and receiver unit of each installation will be operational so as to respond to the selective calls to be made from a monitoring station onshore, according to the operational functions of each buoy.

The grouping arrangement for the three ranges are illustrated in Figure 3.1.

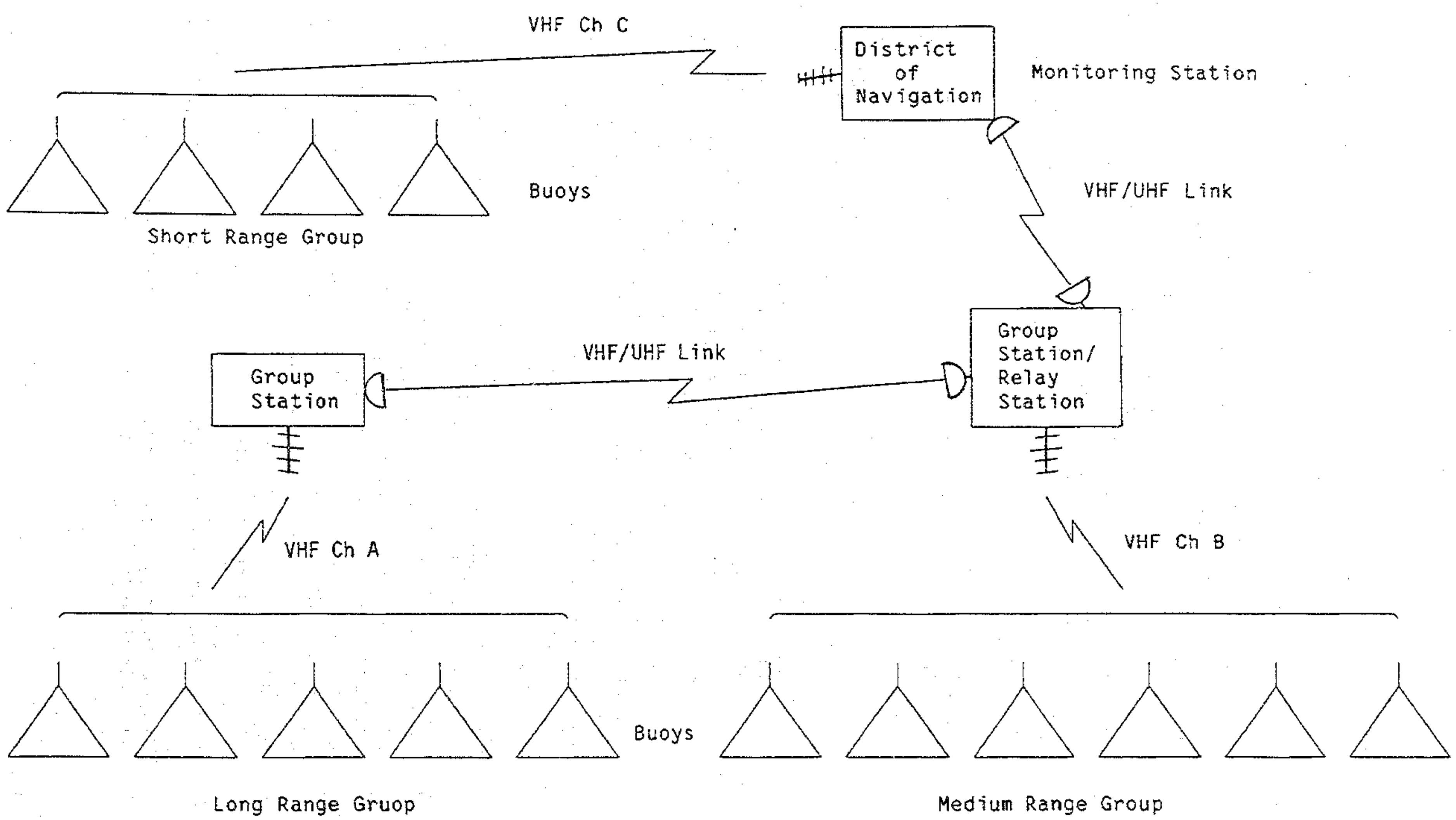


Figure 3.1
System Configuration of Light Remote Monitoring System

(3) Availability/Reliability

1) Targets

A lighthouse authority should set down categories of availability each defined by a minimum level below which it would consider an aid as substandard and make all its effort to improve its availability. The authority should also set down an absolute minim level of availability below which it would discontinue an aid in order to concentrate its resources on a reduced number of aids operating satisfactorily.

In the absence of specific considerations, the availability should be generally categorized as follows:

- major lighthouses, leading lights and manned light vessels have an availability exceeding 99.8%.
- other lights on fixed structures or lanby have an availability exceeding 99%.
- light buoys have an availability ranging from 99.9% to 97%, depending on local conditions and type of power supply.

As regards radio aids the availability gives generally about 99.6%.

However, many radio aids are being replaced with updated equipment and a better figure is expected to be achieved in the future.

The determination of minimum levels is intended only for use within the lighthouse authorities a san attempt to maximize the overall service rendered to the mariner according to available resources.

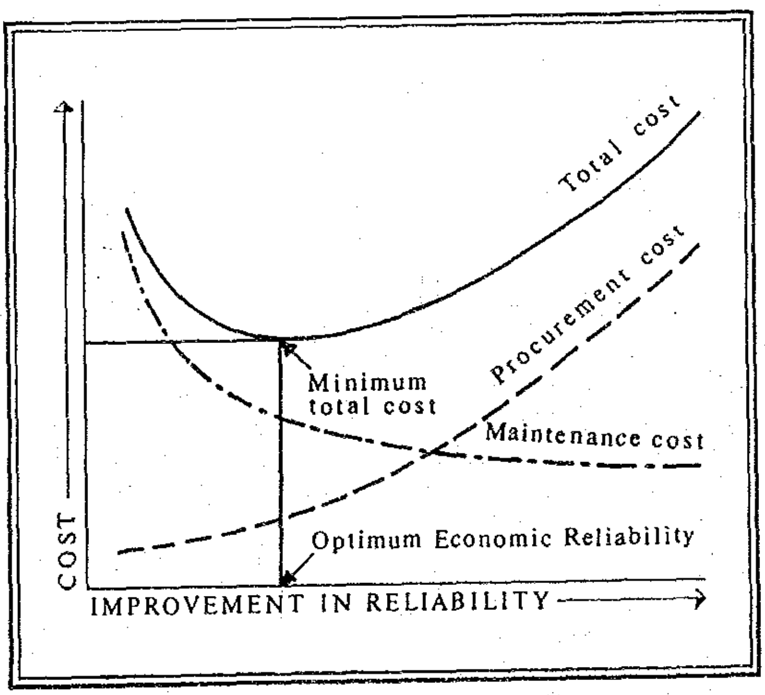
These long term availability objectives must not appear in nautical publications as they cannot represent a commitment of the lighthouse authorities towards seafarers in any particular short period.

2) Economic aspects of reliability/availability

In general, reliability costs money, and the cost of equipment procurement, including development, design and manufacture, increases with increasing reliability. The latter can be achieved by raising the quality of the whole design and manufacturing process. Also, as is common practice with lighthouse authorities, by preventive maintenance and providing the system with redundancy in the form of one or more stand by equipments in reserve which can be brought into service on failure of the working equipment, or in the form of active (parallel) redundancy, wherein all means for performing a given function are operating simultaneously. This also will increase initial capital costs.

However, unreliability also carries a cost penalty in terms of increased maintenance costs, spares provisioning, and, where appropriate, loss of revenue or other related costs arising from failure. This relationship is complex, but as a general principle, there is a trade-off situation where the cost of reliability and the cost of failure are minimized. This is illustrated by the curve of Figure 3.2.

Figure 3.2
Trade-off b/w Reliability and Cost



3.3.3 Information to the Mariner

It is important to inform the mariner, and keep him informed and updated, with information regarding aids to navigation.

This information falls into two basic categories. Firstly there is information about planned changes, e.g. the establishment of new aids. Secondly there is information about failures to aids to navigation.

When planning his passage the mariner anticipates that the aids to navigation on this route will be functioning in accordance with the advertised characteristics laid down in nautical documentation and on charts.

It is important to give advance notice of planned changes to the authorities responsible for nautical documentation and for running other services on which such information is promulgated in bulletins or by coast radio stations.

When a failure occurs to an aid the aids to navigation authority first has to determine the importance of the aid and of the failure. If it is considered important enough, the authority should initiate steps to ensure adequate notification to the mariner. In the case of failures the promulgation of the information will usually be by radio or other electronic system as this is the quickest and most efficient means of conveying the information.

Some Radio Navigation Systems provide integrity information, and give warning to the mariner of a malfunction in a system.

Information concerning navigational warnings can be obtained from documentation published by the appropriate national authorities such as the United Kingdom Hydrographic Department.

Printed notices to mariners can be used to give information about planned changes, long term failures etc. to enable the navigator to correct his charts.

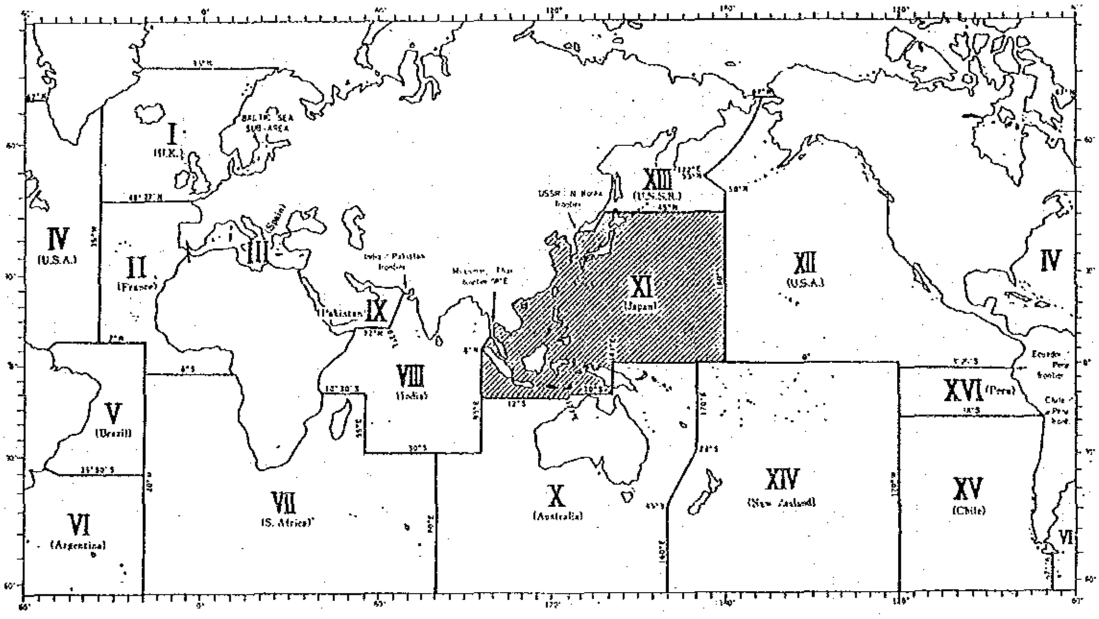
The World-Wide Navigational Warning Service, which was established in 1977 jointly by the International maritime Organization (IMO) and the International Hydrographic Organization (IHO), aims at the promulgation by radio of important information affecting the safety of navigation of ocean-going and coastal shipping.

Such information essentially concerns failures of, or modifications to, important aids to navigation, the discovery of new hazards and wrecks in the main shipping lanes, various operations which might affect safety (extensive exercises by naval forces, mining work, cable laying, search and rescue operations, etc.) and, in general, any factors likely to involve modifications of established routes.

In the context of safeguarding human life, it has been recognized as being of great importance to human safety to promulgate warnings concerning shipping and aircraft on the high seas orin the air space above them with which contact has been lost, which are abnormally overdue, or which may be in distress or lost.

To this effect the world is divided into 16 NAVAREAS (see chart).

GEOGRAPHICAL AREAS FOR COORDINATING AND PROMULGATING NAVAREA WARNINGS



For each NAVAREA, an Area Coordinator is responsible for collecting information, analyzing it and diffusing radio navigational warnings (NAVAREA Warnings), principally to ocean-going shipping.

Such NAVAREA Warnings, transmitted in English and, where appropriate, in another language, are promulgated by radio telegraphy, radiotelephony, Digital Selective Calling (DSC), Enhanced Group Calling (EGC) and in some areas by narrow band direct printing (NAVTEX). They cover the whole of the area concerned and portions of adjacent areas.

Each NAVAREA is divided into regions, placed under the authority of "National Coordinators" responsible for collecting information in their regions and taking action to forward it to the Area Coordinator and/or to process it in the form of coastal or local warnings. In the Baltic, a Sub-Area Coordinator has been established to filter information prior to passing to the Area-Coordinator.

The programmes and broadcast schedules ar shown in the List of Radio Signals published by Hydrographic offices and in the publications of the ITU.

As a general rule, an item of information is promulgated for a sufficient lapse of time and according to an appropriate plan to ensure its safe reception at least until it is eventually canceled or published a a Notice to Mariners, if appropriate.

3.4 Required Aids to Navigation

3.4.1 Visual Aids to Navigation

(1) Approximation for desirable number of units

1) Costal aids

In order for ships at sea to be able to fix their positions, it is ideally desirable for them to be able to find two or more marks for their cross bearing on a continuous basis. However, it will be beyond the practice of reality to establish huge number of visual navaids within a limited period of time to meet the above ideal requirements due to the vast amount of resources involved.

Approximation is made hereunder for the number of visual aids to navigation to be needed for obtaining the bearings within 10 n. m. off coast, where average range of coastal aids is estimated at 16 NM, is computed as follows:

a. Single Bearing

$$\frac{\text{(Total length of coastlines)}}{\text{(Separation between lights)}} = \frac{18.679 \text{ n.m}}{24.9 \text{ n.m}} = 750 \text{ units}$$

b. Cross Bearing

$$\frac{\text{(Total length of coastlines)}}{\text{(Separation between lights)}} = \frac{18.679 \text{ n.m}}{12.4 \text{ n.m}} = 1{,}506 \text{ units}$$

2) Other aids

- Danger mark will be installed on such navigation dangers as reef, rock, tiny islands, etc. located on traffic routes and in their vicinity.

- Landfall aids will be installed around the mouth of bays and entrance to port.

- Navaids marking an entrance will be installed at the entrances to approach channels with the cardinal marks properly spaced to indicate the restricted navigable water.

- Navaids indicating the entrances to channels and straits will be installed with the cardinal marks properly separated showing the limit of navigable waters.

- Navaids will be installed at turning points on traffic routes.

- Navaids will be installed on breakwaters.

- Leading lights will be installed as approaching aids to ports and harbours.

- Navigational marks will be installed on structures at sea to mark their existence.

(2) Reasonable number of units

1) The approximation given in (1) above shows the following installation level of navaid units per 100 n.m.

Single bearing installation --- 4 units/100 n.m.
Cross bearing installation --- 8 units/100 n.m.

2) The maritime navigation concerns with the international harmonization especially with the neighboring maritime countries. The present level of lights establishment in the Philippines stands at about 2 per 100 n.m.

This level is far below than that of the neighboring countries like indonesia now working for over 6 in 2,000 while Malaysia currently stands at 7 and Japan at 30.

3) In the Philippines up to the target year of 2010, the establishment of between 6-7 visual units per 100 n.m. is conceived reasonable and practical being supplemented by a long range radio navaids as an optimum mix for the total cost saving including the

maintenance and the navaid availability efficiency.

Accordingly, the reasonable number of visual aids units up to the year 2010 is set at 683 in total at the present level.

The above will achieve the installation level of:

$$\frac{\text{(Light aids)}}{\text{(Coastline)}} = \frac{\text{725 units}}{\text{18,679 n.m.}} = \text{3.88 units/100 n.m.}$$

Where, the light aids of 725 units consist of:

existing 373
new plan 352

4) Fiscal constraints may not allow the immediate establishment of additional 357 navaids but with continuing priority, the target will be gradually realized although this is still below in comparison with our neighboring countries. The project may be implemented by increment starting with the recommendations of DIBAN duly approved by NABAN with availability of funds.

5) While the Philippines is dependent of VATN on the facilities of sight to assist in navigation, the modernization pace is so fast that sooner the justification for the provision of powerful lights diminishes due to the greater use of electronics aids by mariners. Along this line, future plans may be reviewed and thoroughly studied in order that new "inplaced" ATN be not rendered obsolete and wasted.

3.4.2 Electronic Aids to Navigation

(1) Long range radio aids

1) A terrestrial system should be contemplated for the minimum capital spending with the maximum navigation efficiency and the least maintenance saving.

2) Navaid authorities in certain nations debate whether terrestrial system(s) will be navigation system like GPS could be the final solution world-wide.

3) It is, however, the factual movements in maritime nations to have self-reliance radio aids on their own soils, rather than the single system of total reliance on a specific nation in its operation and control.

This reason could easily be attributable to the national security, non-dependence on other nations.

4) Loran-C system is considered consistently the most appropriate terrestrial system, and accordingly contemplated for the Philippines, the main waters of which will be covered by only the single chain.

5) In the majority of case, the establishment of a long range radio aid will influence the waters of more than one nation.

Loran-C could be linked with that of neighboring countries for further coverage expansion. In such case, it requires international coordination and cooperation and may cause to have a fringe benefit of cost sharing.

(2) Radar aids

1) Radar beacon (Racon) is the most commonly and effectively used in the world as the radar aids.

They will be installed for the purpose of:

- identification of navaids
- landfall identification
- center and turning point identification
- to mark new and uncharted hazards, etc.

2) it should be considered reasonable that the number of radar beacons to be installed up to 2010 will be twenty (20) stations, more or less similar number of lighthouse planning.

(3) Local weather information broadcasting system (LWIB)

1) The local weather information broadcasting is not a navaid in a strict definition, but a mariner assistance/preventive system for navigation safety.

2) LWIB provides the users with the information on local weather on a near real-time basis according to the periodical broadcasting of information on the weather locally observed.

3) It should be considered reasonable to install seven(7) LWIB stations up to 2010 to be sited scattering along the main traffic routes.

3.4.3 Supporting Systems

The development of aids to navigation will be effectuated only through well-established supporting system. The navaids and the supporting systems should be one consolidated package in terms of the reliable and efficient operation.

Accordingly, in parallel with the planned establishment of navaids and also taking into account the existing navaid facilities, the following should be developed in the similar priority:

a. Workshops and buoy bases
b. Buoy/lighthouse tenders
c. Navaid remote monitoring and telecommunication network
d. Training of personnel/organization

3.5 Development Plan

3.5.1 Development Plan by Optimum Mix of Visual and Radio Aids and Supporting Systems

(1) The visual and radio aids are supplementary within the common coverages.

A proper mix of navaids significantly reduces economic burden on the authorities in terms of capital spending and maintenance expenditure with the maximum navigation efficiency and safety.

(2) The development plan is made according to the basic policy given below, which primarily derives from the assessment basis referred to in Sub-section 2.2.1.

i) single bearing may be obtainable for coastal navigation in majority of coastal waters.

ii) Cross bearing may be obtainable in priority main routes.

iii) Accurate bearing may be obtainable at important turning points, narrow channels, etc.

iv) Dangers and hazards in and around the routes should be marked.

v) Port entrances, in-port waterways, etc. should be marked.

vi) A long range radio aids should be introduced.

(3) Accordingly, the development of the aids to navigation given below is planned up to the year 2010:

1) Visual aids to navigation 352 units

(a) Lighthouse	22	units
(b) Light beacon		
Large type	49	"
Medium type	73	"
Small type	101	"
(c) Resilient light beacon (RLB)	19	"
(d) Light buoy	88	"

Annex 3.3 includes the allocation plan of visual aids to navigation.

2) Electronic aids to navigation

(a) Loran-C system	1	chain
(b) Racon	20	stations
(c) Local weather information broadcasting system (LWIB)	7	places

3) Supporting Systems

(a) Workshop/buoy base facilities	3	places
(b) Buoy/lighthouse tenders	3	ships

3.5.2 Rehabilitation and Improvement Plan of Visual Aids

The lighthouses and other lights existing are situated at the right locations. There are, however, a number of the existing lights need to be rehabilitated and improved due to their poor light facilities, low luminous range, tear and wear of associated, facilities. The rehabilitation and improvement for such lights are 'must' to secure the navigation safety.

The implementation priority for such rehabilitation and improvement should be planned together with the development plan for new aids to navigation. In the insufficient rate of light availability in Philippine waters, a realistic approach of the simultaneous implementation of both the new development and the rehabilitation and improvement is considered most appropriate.

(1) Rehabilitation of visual aids

Among the total of 331 light stations, 279 are operational while the rest of them are not operational as referred to in Section 3-1-2 present condition of Aids to Navigation. Some of the light beacons are made of wooden pillar and old, some lighthouses using large-scale rotary lighting devices had been rehabilitated nearly twenty years ago.

In this plan, 54 lighthouses/beacons are to be rehabilitated.

(2) Improvement in luminous range

The luminous range of a number of existing lighthouses and light beacons is insufficient. There are a number of lights which need to be improved in their luminous range due to their poor or deteriorated performances.

Their locations vary from wider traffic lanes to ports and harbours. Construction of higher tower should also be planned for the improvement. In this plan, the 46 lights are to be improved in their luminous ranges.

3.5.3 Training of personnel for Aids to Navigation

The training of personnel for aids to navigation is badly required.

The training is divided into the following two courses:
(a) Training of newly recruited personnel
(b) Training of present personnel

The training of newly recruited personnel should be planned on a long term basis under due consideration of establishment of the training facilities or alternatively the aids to navigation course, as a more realistic approach, within the existing maritime training organizations.

The training of the personnel presently engaged in the operation and maintenance of navaids is an urgent issue to be materialized.

This plan should be a short to medium term basis.

The execution of such training may consist of:

(i) Overseas training

The overseas training is to be carried out at appropriate training facilities available overseas.

Those who will receive the training will engage in the maintenance and operation of equipment as well as in the planning and man management field in future.

(ii) Domestic training

The domestic training is to be carried out with the instructors who will have completed the overseas training.

Those who will receive the training are junior level of maintenance and operation personnel.

3.5.4 Cost Estimation

The cost estimation and the quinquennial cost estimation up to the year 2010 are shown in Table 3.5.

3.5.5 Implementation Schedule

The implementation is planned in four phases of every five years up to the year 2010.
In the first ten years the following will be implemented.

(1) Visual aids

Nearly about 70% of the total plan. i.e. 241 units will be newly established and 100% of the rehabilitation/improvement plan will be implemented.

(2) Electronic aids

Near about 40% of the total of racons and LWIB's will be implemented except Loran-C, which will be implemented in the second ten years.

(3) Supporting systems

Nearly about 70% of the total plan will be implemented along with the same line as the visual aids.

Further breakdown is as shown in Table 3.6.

Table 3.5
Cost Estimation

(Unit: ¥ x mil.)

Type / Item / Year	Total			1992-1995		1996-2000		2001-2005		2006-2010	
	Qty	Ave. unit price	Price	Qty	Price	Qty	Price	Qty	Price	Qty	Price
Visual Aids											
Lighthouse	22	110	2,420	8	880	11	1,210	3	330	0	0
LightBeacon Large	49	90	4,410	11	980	18	1,620	13	1,170	7	630
Medium	73	55	4,015	19	1,045	28	1,540	21	1,155	5	275
Small	101	20	2,020	28	560	44	880	26	520	3	60
Resilient Light Beacon	19	25	475	7	175	8	200	4	100	0	0
Light Buoy	88	9	792	21	189	38	342	20	180	9	81
Sub Total	352		14,132	94	3,839	147	5,792	87	3,455	24	1,046
Elec. Aids											
Racon	20	20	400	3	60	5	100	7	100	5	100
Loran C	1		8,000	0	0	0	0	-	0	1	8,000
LWIB	7	60	420	1	60	2	120	2	120	2	120
Sub Total			8,820		120		220		260		8,220
Support System											
Workshop/Buoy Base	3		900	1	400	1	250	1	250	0	0
Buoy/LH Tender	3		4,000	1	1,600	1	1,200	1	1,200	0	0
Sub Total			4,900		2,000		1,450		1,450	0	0
Rehabilitation/Improvement of Visual aids	100		4,575		2,745		1,830	-	0	-	0
TOTAL			32,427		8,704		9,292		5,165		9,266

Table 3.6
Implementation Schedule

(In number of units)

Type \ Year	Up to 2000		Up to 2010		Total
	1992～1995	1996～2000	2001～2005	2006～2010	
1) Visual Aids					
(a) Lighthouse	8	11	3	0	22
(b) Lightbeacon					
Large type	11	18	13	7	49
Medium type	19	28	21	5	73
Small type	28	44	26	3	101
(c) Resilient light beacon	7	8	4	0	19
(d) Lightbuoy	21	38	20	9	88
	241 (68.5%)		111 (31.5%)		352
2) Elec. Aids					
(a) Loran C	0	0	0	1	1
(b) Racon	3	5	7	5	20
(c) LWIB	1	2	2	2	7
	11 (39.3%)		17 (60.7%)		28
3) Support System					
Workshop/Buoy base	1	1	1	0	3
Buoy/Lighthouse tender	1	1	1	0	3
	4 (66.7%)		2 (33.3%)		6

3.5.5 Recommendations

The Philippines consisting of numerous number of islands is dependent largely upon the sea, land and air transportation of cargoes and passengers. Especially its geographic conditions require the role of sea transport to an extraordinary extent. Thus, securing the safety of the maritime activities is vital importance for the nation. Many human lives and properties have been lost every year due to marine accidents involving passenger ships, cargo ships, sailing ships. fishing boats, etc.

In view of the above situations, the development of aids to navigation in parallel with the improvement and rehabilitation of the existing aids are in substantial necessity to secure the safe and efficient traffic routes for sea transport.

The present number of aids to navigation in the Philippines is extremely insufficient and in the absolute shortage, though the locations of existing aids are at the right sites.

(1) Simultaneous implementation of new development and improvement and rehabilitation of existing aids

The development of new aids to navigation and the improvement and rehabilitation of the existing aids should be implemented harmoniously on a simultaneous basis to primarily cover the prime traffic routes.

(2) Supporting/logistic system

The aids to navigation and the supporting/logistic facilities should be developed and improved always in one package.

The existing supporting/logistic system for aids to navigation must be improved considerably to suffice the maintenance requirements in order to meet the ever increasing demands for the reliable operation of aids to navigation.

(3) Optimum mix of visual and radio aids

A proper mix of visual and radio aids should be planned. Especially in short/coastal ranges the visual and short range radio aids have supplementary role to double the functions of the aids.

(4) Standardization of aids to navigation

the standardization of equipment and system should be pursued for the aids to navigation to materialize the following benefits:

- fewer maintenance facilities and personnel
- less spares, less space and less capital due to the interchange ability and flexibility
- better liaison between authorities and manufacturers for economies

(5) ATN training

The training to grade up in quality of the personnel is the key factors for the reliable operation of aids to navigation.
The training for ATN personnel should be carried out in a high priority using the existing maritime training facilities as a provisional means.
Training is time consuming and expensive, but never wasted.

Annex 3.1
International Movement of Aids to Navigations Field

There will be continuous requirement for the traditional aids for many years to come, as mariners have been dependent for hundreds of years on their own facilities of sight and hearing to assist their navigation.

It is however, apparent that modern technology has also been playing an increasingly important role, and such trend will continue to increase world-wide.

The appropriate mix of the traditional facilities of visual aids and the modern technology of electronic aids are the general requirements having been implemented in maritime nations.

As the continuing and increasing trend in the world nowadays is that more ships of all sizes carry some form of electronic positioning system, the justification for the provision of powerful lights diminishes due to the greater use of electronic aids by mariners.

International communality in the operational and technical requirements for marine aids to navigation has been worked out by the International Association of Lighthouse Authorities (IALA), which has produced the recommendations, guidelines, manuals and suggestions for aids to navigation, and it should be noted that all marine aids to navigation must conform with them wherever applied.

The Global Positioning System (GPS) appears to be a widespread national and international civil use, and the long term impact of GPS on traditional aids to navigation could be significant, while the foci of debates among nations having a sprit of independence are on this US control system which is primarily for the security in the interest of US and its allies.

Although there seems to be hardly any other means reasonably available to the civil users to obtain a global capability equivalent to that provided by GPS, a terrestrial rationavigation system to complement the global satellite navigation system is a fundamental requirement of maritime sectors as their own-nation control system.

The Loran-C system is a long range, all-weather, highly accurate and reliable radio navigation system for general navigation.
In recognition of its inter operability, long range, high availability and accuracy, IALA has adopted a policy to support and encourage cooperative efforts between the member nations to expand and improve Loran-C coverage throughout the world as standard terrestrial radio navigation system including the establishment of Loran-C chains, wherever this is practicable.

With IALA as the leader of promotion, interested countries in the world have been discussing the introduction of Loran-C, which is regarded to be worth to prevent here and summarized in the Annex 3.2.

As regards the coastal and short range radio navigation, Racons are most popularly used by radar equipped ships owing to its advantage of all weather aids for the following purposes:

- ranging of and identification of positions on inconspicuous coastlines
- identification of aids to navigation, both seaborne and land based
- landfall identification
- centre and turning point identification in precautionary areas or TSS
- to mark new and uncharted hazards
- to indicate navigable spans under bridges
- an leading line racons

As the number of radar-equipped vessels will eve increase for navigation safety, the demands for racons will be in a constant rise.

The visual aids and racons are complementary, and function as a confirmatory mark each other.
It is, therefore, the general practice for aids to navigation services to make co-installation of both the aids, wherever the locations are important.

The use of electronic aids will increase particularly as their greater production is likely to result in them becoming relatively inexpensive.

Annex 3.2
Loran-C for Maritime Use the Current World Wide Situation

N.W. EUROPE

The adoption of Loran as the future back-up aids in Europe would give a new lease of life to equipment manufacturers and a high degree of equipment standardization. Additionally, it will give the obvious advantages of increased range, a wider range of land, sea and air use and of providing a regionally based and independently controlled system.

An International Agreement concerning the establishment and operation of the Civil Loran-C Navigation System in North West Europe and the North Atlantic, is under discussion at an international working group, Loran-C Policy Group consisting of official representatives from Canada, Denmark, Germany, France, Iceland, Ireland, The Netherlands and Norway, with the U.S. Coast Guard, the International Association of Lighthouse Authorities (IALA) and the Commission of the European Communities (EEC) as active observers.

The signing of an International Agreement committing all signatories to go on with the project will have to happen in early February 1992 at the latest to meet national requirements in some countries and to be able to take over the USCG stations in the area by 1 January 1995 which is the deadline for U.S. Loran-C engagement in NW Europe.

The slow progress towards a NW European Loran-C system is partly due to the fact that GPS is approaching operational status. It is also true that the GPS syndrome has hit some countries harder than others and introduced uncertainties as to the need for Loran-C. In this regard it is very encouraging to note the development within IALA of a formal policy supporting Loran-C on a world-wide basis, has been agreed. Also, the position of the Commission of the European Communities strongly supports the Loran-C concept for the whole of Europe. Finally, the Soviet interest in cooperating with the NW European counties towards a common system based on cooperation between Loran-C and Chayka is of great importance. This is particularly important for Germany and Norway since these countries will not be able to fully cover the areas of interest within the NW European system.
c.f.: Chayka is the CIS (old USSR) version of Loran-C.

The Far East

The 2nd meeting of the "Far East Loran-C/Chayka" Group, known as FELT was held from 14th-10th September 1991.

The FELT Group comprises Japan, China, Korea and the Soviet Union and the first meeting was in Moscow in march 1991. Great progress was made towards an agreement to run cooperative chains in Chayka and Loran-C throughout the area.

The principal reason for this progress was that the four nations that came to the meeting wanted to agree. The second meeting in Tokyo enabled most of the technical problems to be solved leaving only some details outstanding for the next meeting.

With regard to coverage, it was agreed that this would be dealt with in two stages. The first stage is the coverage by 5 chains.

The second stage will require a further chain maybe in cooperation new members.

The target completion date for Phase 1 is 1st January 1995.

At some future stage, consideration maybe given to attempting to interest Indonesia, as Japanese shipping is greatly concerned about navigational safety in the Malacca Straits.

The Agreement worked out is quite neat inasmuch as each of the four concerned countries will have at least 1 master station on its own soil, and each chain will have stations in at least 2 countries. A truly cooperative effort.

The Japanese Government is currently in negotiation with the US Government concerning host national operation and the terms on which the stations operated by the US Coast Guard can be handed over.

With regard to the <u>timing standard</u> for the chains it was agreed that:

1. The master stations of all chains to be synchronized to within $\pm$ 2.5 s of UTC, by 1st January 1995.

2. Experience gained in operating the chains should permit the tolerance to be reduced to $\pm$ 0.2 s, in the longer term.

It was also agreed that:

3. In principle, System Area Monitoring (SAM) should be used as the means of ensuring that the tolerances of the transmitters are maintained;

4. An out of tolerance baseline will be indicated to users by "blinking". In this regard the USSR undertook to study introduction of "blink" to the Chayka stations of Chain B.

5. The Agencies providing the master station of a chain will be responsible for preparing detailed plans of the control and communication arrangements proposed for the chain in time for the meeting in May 1992.

As regards <u>geodetic datum</u> it was recognized that although the nautical charts of the different countries were based on different geodetic datums, there was a need for all the stations in the radio navigation service to use a common reference datum, from which corrections for any other datum could be derived, if necessary.

It was therefore agreed that:

6. The positions of all transmitters would be defined in WGS 84 coordinates:

7. The positions of some, or all, of the transmitters may also be described in the coordinates of local geodetic datums, such as the Krasovskiy (1942) datum, WGS72, the Tokyo datum or others as required by administrations.

Concurrently with the technical discussions, FELT 2 developed an Agreement to be signed by all parties.

To avoid political problems and long delays, it was decided that the Agreement should be an inter agency Agreement rather than an Agreement between Government, that is to say:

Maritime Safety Agency	for Japan
Korea Maritime and Port Administration	for Rep. of Korea
Internavigation Committee	for USSR
Aids to Navigation Division, Ministry of Communications	for China

To avoid many of the pitfalls that faced NW Europe in its cost sharing agreement, it was decided that each administration would bear all the costs pertaining to transmitters on their soil.

To ensure the smooth running of the operation, a Council will be established comprising one member from each of the four Administrations. The Council will meet once a year and the language of the Council will be English. Each Councilor will be responsible for his or her travelling expenses, and the Chairmanship of the Council will be rotated among the 4 members.

The Chair will be responsible for organizing and hosting the next meeting and will be responsible for any incidental expenses during the one year term of office.

Finally it was decided that as it is an inter agency Agreement, IALA would act as the depositary organization.

The next meeting, FELT 3, will be held at IALA Headquarters in May 1992 when it is hoped that all outstanding matters will be cleared up.

It is planned that the Agreement will be formally signed by the four countries in September 1992 in Moscow.

The Far East situation can be considered as a model of international cooperation in the radio navigation field. It involves four countries with very different backgrounds. It poses some difficult technical questions, financial problems and political problems.

All these matters were sorted out because the four Administrations concerned really wanted to cooperate with one another for the benefit of the International Maritime Community.

The Mediterranean and the Iberian Peninsula

The existing US Coast Guard Mediterranean Chain comprises 4 stations, one in Spain, two in Italy and one in Turkey.

Discussions up to now have been greatly hampered as it had not proved possible to interest Turkey in maintaining the Kargaburun station after the US withdrawal at the end of 1994.

With no station in Turkey, Italy would have no coverage to the East which is in fact their main area of interest.

However, quite recently the Turkish Authorities have intimated that they have now decided to take part in the discussions so the situation in much more hopeful. The next meeting of the group is in November 1991.

The Mediterranean discussions also have another dimension as the USSR is keen to link Chayka Chains with the Mediterranean Chain to ensure coverage of the Black Sea.

At the same time, France is discussing with Spain and Portugal coverage of the entire Iberian or Spanish Peninsula by utilizing its stations at Lessay and Soustons.

These discussions are proceeding well.

Other areas of Europe

Apart from the general NW European situation, Norway and Germany are having discussions with the USSR with a view to improving Loran-C/Chayka coverage in the Baltic and North of Norway. These bilateral and trilateral discussions are proceeding well.

The European Community is keenly interested in all these developments as the Commission can visualize complete coverage of the European area if all these plans come to fruition.

USA and Canada

The Mid Continent Gap in the U.S. is now dealt with and that Loran-C can look forward to a rosy future in this area.

The US Coast Guard and the USSR Internavigation Committee are carrying out exciting joint operations following the signing of an agreement in 1988 to establish a joint Chayka/Loran-C chain in the Bering sea.

Canada is currently concerned by the NW European situation as it is keen to have coverage across the North Atlantic. Much depends upon the decision of Iceland as to whether this can be realized.

South America

Venezuela is carrying out serious studies as to the needs and viability of coverage in their area. IALA was approached for an opinion and they were informed that IALA policy is to pursue the furtherance of Loran-C/Chayka coverage.

South Africa

South Africa is studying the introduction of Loran-C principally for land users.

Middle East

The Saudi Chains are still in operation and are considered to be a valuable aid to navigation in Saudi waters and those of neighbouring countries.

India

The two Indian Chains are under construction and are expected to come on stream soon.

IALA POLICY

To strengthen the efforts of those seeking to implement Loran-C and Chayka the IALA Council passed a resolution at its meeting in April 1991.

This resolution read as follows:

IALA Policy on terrestrial navigation systems

The International Association of Lighthouse Authorities:

CONVINCED that there will be a requirement for a terrestrial radio navigation system, to complement global satellite navigation systems for the foreseeable future:

CONSIDERING that to reduce costs to users and providers and to maximize the usefulness of the system, a standard terrestrial radio navigation system should be adopted where possible:

RECOGNIZING that the inter operability, long range, high availability and accuracy of the Loran-C and Chayka systems, make these the preferred systems for adoption as a standard, world wide terrestrial radio navigation systems:

HAS ADOPTED A POLICY to support and encourage cooperative efforts between member nations to expand and improve Loran-C and Chayka coverage throughout the world, including the establishment of joint Loran-C/Chayka chains, wherever this is practicable.

Thus it can be seen that elsewhere slow but sure progress is being made towards the goal of wide coverage of the world by a terrestrial based system that will be complementary to the satellite systems now being put into place.

Annex 3.3
Alocation Plan of Visual Aids to Navigation

No	Location	Type	Range N.M.	Position	Remarks
MC 1	BAETO Pt.	LH	20	13° 29′ 36″ 120° 39′ 08″	
MC 2	DUYAGAN Pt.	LH	20	12° 36′ 40″ 121° 33′ 08″	
MC 3	SIBUYAN I.	LH	20	12° 29′ 00″ 122° 39′ 10″	
MC 4	CALATON Pt.	LH	20	12° 11′ 00″ 123° 03′ 08″	
MC 5	KALIBO	LH	20	11° 43′ 30″ 122° 22′ 50″	
MC 6	CADURUAN Pt.	LH	20	11° 43′ 30″ 124° 04′ 00″	
MC 7	LUMANGBAYAN Pt.	LBL	15	13° 17′ 10″ 121° 21′ 15″	
MC 8	BONDOC Pt.	LBL	15	13° 10′ 00″ 122° 35′ 15″	
MC 9	PAGBULUNGAN Pt.	LBL	15	12° 13′ 25″ 123° 13′ 45″	
MC 10	OHITAY I.	LBL	15	11° 38′ 52″ 122° 50′ 30″	
MC 11	SICOGON I.	LBL	15	11° 26′ 40″ 123° 16′ 25″	
MC 12	CANAGUAYAN Pt.	LBL	15	11° 03′ 40″ 124° 21′ 45″	
MC 13	PAGTUGLAN Pt.	LBL	15	10° 35′ 15″ 124° 16′ 20″	
MC 14	GUARDIA SHOAL	LBM	10	14° 24′ 08″ 120° 30′ 00″	
MC 15	LIMBOONES I.	LBM	10	14° 14′ 30″ 120° 35′ 15″	
MC 16	PAGBILO I.	LBM	10	13° 53′ 30″ 121° 45′ 15″	
MC 17	LOCOLOCO Pt.	LBM	10	13° 39′ 28″ 121° 25′ 15″	
MC 18	MATOCO Pt.	LBM	10	13° 38′ 09″ 121° 02′ 06″	
MC 19	PAPAYA Pt.	LBM	10	13° 37′ 40″ 120° 54′ 15″	
MC 20	VERDE I. WEST END	LBM	10	13° 34′ 30″ 121° 02′ 40″	
MC 21	VERDE I. NORTH END	LBM	10	13° 34′ 30″ 121° 05′ 00″	
MC 22	SAN ANDRES Pt.	LBM	10	13° 34′ 17″ 121° 52′ 00″	
MC 23	SALOMAGUE Pt.	LBM	10	13° 22′ 30″ 122° 08′ 45″	
MC 24	ELEFANTE I.	LBM	10	13° 11′ 30″ 121° 59′ 45″	
MC 25	BATUANAN Pt.	LBM	10	12° 55′ 30″ 121° 44′ 00″	
MC 26	COBRADOR I. NORTH END	LBM	10	12° 40′ 00″ 122° 14′ 16″	

No	Location	Type	Range N.M.	Position	Remarks
MZ 13	CORONADO Pt.	LBL	15	7° 57′ 20″ 122° 13′ 20″	
MZ 14	TALULU Pt.	LBL	15	7° 31′ 30″ 122° 04′ 30″	
MZ 15	MANGSOAGUI Pt.	LBM	10	12° 09′ 40″ 121° 08′ 02″	
MZ 16	TEINGA I. NORTH END	LBM	10	6° 54′ 30″ 121° 35′ 07″	
MZ 17	MALANITA I. SOUTH END	LBM	10	6° 52′ 18″ 122° 17′ 24″	
MZ 18	BALUKBALUK I. NORTH END	LBM	10	6° 41′ 48″ 121° 42′ 36″	
MZ 19	MATANAL Pt.	LBM	10	6° 37′ 28″ 122° 19′ 36″	
MZ 20	MANADI I.	LBS	5	12° 19′ 45″ 121° 02′ 34″	
MZ 21	DONGON REEF	LBS	5	12° 19′ 00″ 121° 00′ 15″	
MZ 22	SECO I.	LBS	5	11° 19′ 16″ 121° 39′ 45″	
MZ 23	SOMBRERO Rk.	LBS	5	10° 43′ 15″ 121° 33′ 00″	
MZ 24	BATUPARE Pt.	LBS	5	6° 45′ 12″ 122° 04′ 05″	
MZ 25	KALUITAN I.	LBS	5	6° 35′ 36″ 121° 46′ 42″	
MZ 26	GREAT GOUNAN I. EAST END	LBS	5	6° 33′ 00″ 121° 51′ 56″	
MZ 27	ILIN STRAIT SOUTH ENTRANCE	RLB	5	12° 14′ 30″ 121° 06′ 26″	
MZ 28	BASILAN	RLB	5	6° 42′ 22″ 121° 57′ 09″	
MZ 29	ZAMBOANGA No.2	B	5	6° 53′ 55″ 122° 04′ 42″	
MZ 30	SANTA CRUZ BANK NORTH	B	5	6° 53′ 49″ 122° 00′ 33″	
MZ 31	SANTA CRUZ BANK WEST	B	5	6° 52′ 50″ 121° 59′ 04″	
MZ 32	SANTA CRUZ BANK EAST	B	5	6° 52′ 25″ 122° 05′ 04″	
MZ 33	SANTA CRUZ BANK SOUTH	B	5	6° 51′ 15″ 122° 04′ 05″	
ZD 1	FLECHA Pt.	LH	20	7° 21′ 35″ 123° 24′ 05″	
ZD 2	QUIDAPIL Pt.	LH	20	6° 49′ 25″ 123° 55′ 45″	
ZD 3	PALIMBANG Pt.	LH	20	6° 11′ 50″ 124° 10′ 30″	
ZD 4	BAIS Pt.	LBL	15	6° 39′ 45″ 126° 04′ 12″	
ZD 5	TUBALAN HEAD	LBL	15	6° 28′ 40″ 125° 35′ 30″	
ZD 6	BUCA Pt.	LBL	15	5° 57′ 30″ 124° 40′ 24″	

No	Location	Type	Range N.M.	Position	Remarks
MC 27	SANGILAN Pt.	LBM	10	12° 34′ 20″ 121° 59′ 30″	
MC 28	CABODIANGAN Pt.	LBM	10	12° 26′ 30″ 122° 25′ 16″	
MC 29	MACATOL Pt.	LBM	10	12° 19′ 15″ 121° 55′ 20″	
MC 30	CARNASA I.	LBM	10	11° 31′ 50″ 124° 06′ 00″	
MC 31	OGTON Pt.	LBM	10	11° 21′ 00″ 123° 53′ 45″	
MC 32	PANGPANG Pt.	LBM	10	11° 19′ 15″ 124° 20′ 15″	
MC 33	DULJUGAN Pt.	LBM	10	10° 55′ 30″ 124° 22′ 15″	
MC 34	CORREGIDOR I. NORTH END	LBS	5	14° 23′ 45″ 120° 34′ 15″	
MC 35	CABALLO I. WEST END	LBS	5	14° 22′ 00″ 120° 36′ 45″	
MC 36	MALAVATUAN I.	LBS	5	13° 52′ 00″ 120′ 20′ 30″	
MC 37	SUMBRERO I.	LBS	5	13° 41′ 07″ 120° 49′ 32″	
MC 38	TUQUIAN Pt.	LBS	5	13° 36′ 05″ 122° 12′ 25″	
MC 39	VERDE I. SOUTH END	LBS	5	13° 31′ 45″ 121° 04′ 45″	
MC 40	MOMPOG I. NORTH EAST END	LBS	5	13° 31′ 37″ 122° 10′ 50″	
MC 41	BACOCHIO I.	LBS	5	13° 29′ 08″ 121° 10′ 45″	
MC 42	DOS HRMANAS I.	LBS	5	13° 01′ 45″ 121° 53′ 00″	
MC 43	TUGBUNGAN Pt.	LBS	5	12° 57′ 15″ 122° 05′ 30″	
MC 44	BANTONCILLO I.	LBS	5	12° 51′ 50″ 122° 00′ 15″	
MC 45	BIARINGAN SOUTH END	LBS	5	12° 37′ 40″ 122° 09′ 44″	
MC 46	CRESTA DE GALLO I.	LBS	5	12° 08′ 53″ 122° 40′ 30″	
MC 47	PULANDUTA Pt.	LBS	5	11° 54′ 30″ 123° 10′ 00″	
MC 48	PONTUD BANK NORTH END	LBS	5	11° 52′ 30″ 122° 14′ 10″	
MC 49	GORRITI SHOAL WEST END	LBS	5	11° 48′ 15″ 123° 37′ 45″	
MC 50	GORRITI SHOAL EAST	LBS	5	11° 47′ 00″ 123° 50′ 37″	
MC 51	NORTH GIGANTE I. NORTH EAST	LBS	5	11° 46′ 00″ 123° 30′ 50″	
MC 52	ZAPATO MAYOR I.	LBS	5	11° 45′ 30″ 123° 01′ 30″	
MC 53	ZAPATO MENOR I.	LBS	5	11° 43′ 30″ 122° 58′ 45″	

No.	Location	Type	Range N.M.	Position	Remarks
MC 54	CUCARACHA SHOAL NORTH EAST END	LBS	5	11° 40′ 46″ 123° 10′ 16″	
MC 55	GIGANTANGAN I.	LBS	5	11° 34′ 40″ 124° 15′ 45″	
MC 56	MARIA I.	LBS	5	11° 29′ 50″ 124° 06′ 40″	
MC 57	BANTAYAN I. NORTH RF.	LBS	5	11° 24′ 00″ 123° 44′ 15″	
MC 58	MALAPASCUA I. SOUTH END	LBS	5	11° 19′ 14″ 124° 06′ 45″	
MC 59	CAMPATOC Rf.	LBS	5	11° 13′ 44″ 124° 04′ 45″	
MC 60	CALANGAMAN I.	LBS	5	11° 06′ 45″ 124° 15′ 00″	
MC 61	PILAR Pt.	LBS	5	10° 48′ 45″ 124° 34′ 03″	
MC 62	TALONG I.	LBS	5	10° 43′ 20″ 124° 18′ 45″	
MC 63	PORO I. EAST END	LBS	5	10° 39′ 35″ 124° 30′ 33″	
MC 64	MAHAMA I.	LBS	5	10° 32′ 15″ 124° 38′ 07″	
MC 65	DANA JON BANK	LBS	5	10° 21′ 00″ 124° 21′ 45″	
MC 66	PANGULAN Pt. (CEBU No.14)	LBS	5	10° 20′ 00″ 124° 02′ 30″	
MC 67	BANILAD SHOAL WEST (CEBU No.7)	LBS	5	10° 18′ 29″ 123° 55′ 40″	
MC 68	NORTHEAST PASS. EAST ENTRANCE	LBS	5	10° 18′ 06″ 124° 27′ 54″	
MC 69	CEBU No.5	LBS	5	10° 17′ 28″ 123° 53′ 46″	
MC 70	OLANGO I. NORTH EAST END	LBS	5	10° 17′ 15″ 124° 04′ 30″	
MC 71	CAUIT I. (CEBU No.4)	LBS	5	10° 16′ 21″ 123° 52′ 50″	
MC 72	TOOD I. EAST Rf.	LBS	5	10° 15′ 16″ 124° 39′ 48″	
MC 73	ADAM Rf.	LBS	5	10° 14′ 48″ 124° 42′ 06″	
MC 74	OLANGO I.	LBS	5	10° 14′ 30″ 124° 00′ 52″	
MC 75	CARICHUCHI Pt. (CEBU No.14)	LBS	5	10° 13′ 54″ 123° 56′ 42″	
MC 76	BOGO SHOAL (CEBU No.1)	LBS	5	10° 13′ 36″ 123° 51′ 08″	
MC 77	OLAGNO I. SOUTH WEST END	LBS	5	10° 11′ 15″ 123° 58′ 50″	
MC 78	GREEN Pt.	LBS	5	10° 09′ 37″ 124° 45′ 50″	
MC 79	TUGAS Pt.	LBS	5	10° 09′ 02″ 124° 37′ 03″	
MC 80	MANILA No.15	RLB	5	14° 34′ 13″ 120° 55′ 24″	

No	Location	Type	Range N.M.	Position	Remarks
MC 81	MANILA No.16	RLB	5	14° 34′ 13″ 120° 56′ 22″	
MC 82	MANILA No.14	RLB	5	14° 34′ 07″ 120° 56′ 58″	
MC 83	MANILA No.13	RLB	5	14° 33′ 24″ 120° 56′ 22″	
MC 84	MANILA No.18	RLB	5	14° 32′ 49″ 120° 56′ 17″	
MC 85	MANILA No.12	RLB	5	14° 32′ 42″ 120° 55′ 45″	
MC 86	MANILA No.5	RLB	5	14° 24′ 32″ 120° 44′ 13″	
MC 87	CEBU PORT NORTH ENTRANCE (CEBU No.12)	RLB	5	10° 20′ 12″ 124° 00′ 13″	
MC 88	MANILA No.17	B	5	14° 40′ 20″ 120° 55′ 30″	
MC 89	MANILA No.10	B	5	14° 34′ 50″ 120° 52′ 30″	
MC 90	MANILA No.9	B	5	14° 34′ 30″ 120° 51′ 15″	
MC 91	MANILA No.11	B	5	14° 34′ 15″ 120° 54′ 15″	
MC 92	MANILA No.8	B	5	14° 33′ 20″ 120° 51′ 30″	
MC 93	MANILA No.7	B	5	14° 31′ 40″ 120° 50′ 30″	
MC 94	MANILA No.6	B	5	14° 29′ 45″ 120° 48′ 30″	
MC 95	SABANG Pt. (ROMBLON No.3)	B	5	12° 35′ 20″ 122° 15′ 35″	
MC 96	GUINJOAN Pt. (ROMBLON No.1)	B	5	12° 35′ 02″ 122° 14′ 49″	
MC 97	MALABASA Pt. (ROMBLON No.2)	B	5	12° 34′ 51″ 122° 15′ 07″	
MC 98	ROMBLON I. WEST	B	5	12° 34′ 10″ 120° 13′ 50″	
MC 99	PORT BATAN NORTH ENTRANCE	B	5	11° 38′ 00″ 122° 30′ 00″	
MC100	CEBU No.11	B	5	10° 20′ 43″ 123° 59′ 25″	
MC101	CEBU No.13	B	5	10° 20′ 41″ 124° 00′ 00″	
MC102	CEBU No.10	B	5	10° 20′ 18″ 123° 58′ 38″	
MC103	CEBU No.9	B	5	10° 19′ 31″ 123° 57′ 38″	
MC104	CEBU No.8	B	5	10° 18′ 57″ 123° 56′ 21″	
MC105	CEBU No.6	B	5	10° 17′ 10″ 123° 53′ 55″	
MC106	CEBU No.3	B	5	10° 15′ 30″ 123° 52′ 49″	
MC107	CEBU No.2	B	5	10° 14′ 42″ 123° 52′ 48″	
MC108	CEBU No.15	B	5	10° 13′ 30″ 123° 54′ 37″	

No	Location	Type	Range N.M.	Position	Remarks
CC 1	SULAUAN Pt.	LH	20	8° 37′ 00″ 124° 28′ 30″	
CC 2	LAYABAN Pt.	LH	20	8° 31′ 10″ 123° 47′ 00″	
CC 3	GORDA Pt.	LBL	15	9° 36′ 03″ 124° 14′ 10″	
CC 4	MEDANO Pt.	LBL	15	9° 15′ 40″ 124° 39′ 15″	
CC 5	MINALULAN Pt.	LBL	15	9° 09′ 00″ 123° 41′ 50″	
CC 6	AGIO Pt.	LBM	10	9° 45′ 15″ 124° 35′ 30″	
CC 7	TANON Pt.	LBM	10	9° 25′ 00″ 123° 19′ 33″	
CC 8	TAMBISAN Pt.	LBM	10	9° 11′ 15″ 123° 27′ 15″	
CC 9	DIUATA Pt.	LBM	10	9° 05′ 30″ 125° 12′ 30″	
CC 10	FAROL Pt.	LBM	10	9° 04′ 50″ 124° 46′ 10″	
CC 11	CARCAR Pt.	LBS	5	10° 05′ 15″ 123° 40′ 30″	
CC 12	ARGAO Pt.	LBS	5	9° 52′ 40″ 123° 36′ 00″	
CC 13	DUMAGUETE. PIER	LBS	5	9° 18′ 47″ 123° 18′ 37″	
CC 14	DIPOLOG	LBS	5	8° 35′ 42″ 123° 20′ 16″	
CC 15	NASPIT	B	5	8° 59′ 43″ 125° 20′ 03″	
CC 16	CAGAYAN DE ORO	B	5	8° 31′ 08″ 124° 39′ 50″	
CC 17	OZAMIZ	B	5	8° 10′ 30″ 123° 55′ 00″	
MA 1	ABULUG	LH	20	18° 27′ 00″ 121° 26′ 45″	
MA 2	CANDON Pt.	LH	20	17° 12′ 30″ 120° 24′ 05″	
MA 3	MAYRAIRA Pt.	LBL	15	18° 38′ 40″ 120° 50′ 50″	
MA 4	SANT CATALINA	LBL	15	17° 35′ 00″ 120° 20′ 20″	
MA 5	DARIGAYAS	LBL	15	16° 50′ 00″ 120° 20′ 00″	
MA 6	CAMIGUIN I. WEST END	LBM	10	18° 52′ 30″ 121° 50′ 00″	
MA 7	PUERTO Pt.	LBM	10	18° 30′ 12″ 122° 06′ 50″	
MA 8	TONDUL Pt.	LBM	10	16° 19′ 00″ 120° 01′ 00″	
MA 9	ITBAYAT I. SOUTH WEST END	LBS	5	20° 43′ 10″ 121° 47′ 00″	
MA 10	IBUHOS I.	LBS	5	20° 18′ 15″ 121° 48′ 10″	

No	Location	Type	Range N.M.	Position	Remarks
MA 11	BABUYAN I. WEST END	LBS	5	19° 32′ 30″ 121° 53′ 40″	
MA 12	KIKING Pt.	LBS	5	18° 52′ 30″ 121° 28′ 45″	
MA 13	RONA I.SOUTH RF.	LBS	5	18° 31′ 33″ 122° 09′ 25″	
MA 14	SAN FERNANDO LEPANTO PIER	LBS	5	16° 36′ 48″ 120° 17′ 41″	
MA 15	BOLYINAO No.1	LBS	5	16° 24′ 20″ 119° 52′ 55″	
MA 16	SUAL	LBS	5	16° 04′ 40″ 120° 06′ 35″	
MA 17	FAAG REEF	RLB	5	16° 38′ 50″ 120° 15′ 10″	
MA 18	MASINLOC No.2	RLB	5	15° 32′ 28″ 119° 54′ 00″	
MA 19	MASINLOC No.3	RLB	5	15° 32′ 10″ 119° 54′ 33″	
MA 20	SAN FERNANDO No.1	B	5	16° 38′ 40″ 120° 18′ 00″	
MA 21	SAN FERNANDO No.2	B	5	16° 38′ 10″ 120° 17′ 40″	
MA 22	BOLYINAO No.2	B	5	16° 25′ 15″ 119° 53′ 50″	
MA 23	MASINLOC No.5	B	5	15° 32′ 28″ 119° 55′ 24″	
MA 24	MASINLOC No.4	B	5	15° 32′ 08″ 119° 55′ 14″	
MA 25	MASINLOC No.7	B	5	15° 32′ 08″ 119° 55′ 54″	
MZ 1	TUBILI Pt.	LH	20	13° 13′ 50″ 120° 31′ 30″	
MZ 2	TIBIAO Pt.	LH	20	11° 18′ 00″ 122° 01′ 40″	
MZ 3	DALIPE Pt.	LH	20	10° 45′ 48″ 121° 55′ 24″	
MZ 4	SIATON Pt.	LH	20	90° 02′ 30″ 123° 00′ 54″	
MZ 5	BATORAMTON Pt.	LH	20	7° 06′ 40″ 121° 54′ 10″	
MZ 6	MANGARIN Pt.	LBL	15	12° 31′ 20″ 120° 55′ 10″	
MZ 7	LIBAGAO I.	LBL	15	12° 11′ 52″ 121° 25′ 45″	
MZ 8	IBOT Pt.	LBL	15	11° 54′ 30″ 121° 34′ 35″	
MZ 9	DINAGO Pt.	LBL	15	11° 50′ 20″ 121° 25′ 00″	
MZ 10	COLIPAPA	LBL	15	9° 27′ 42″ 122° 34′ 00″	
MZ 11	BLANCA Pt.	LBL	15	8° 30′ 30″ 123° 03′ 30″	
MZ 12	SINDANGAN Pt.	LBL	15	8° 09′ 45″ 122° 39′ 45″	

No.	Location	Type	Range N.M.	Position	Remarks
MZ 13	CORONADO Pt.	LBL	15	7° 57′ 20″ 122° 13′ 20″	
MZ 14	TALULU Pt.	LBL	15	7° 31′ 30″ 122° 04′ 30″	
MZ 15	MANGSOAGUI Pt.	LBM	10	12° 09′ 40″ 121° 08′ 02″	
MZ 16	TEINGA I. NORTH END	LBM	10	6° 54′ 30″ 121° 35′ 07″	
MZ 17	MALANITA I. SOUTH END	LBM	10	6° 52′ 18″ 122° 17′ 24″	
MZ 18	BALUKBALUK I. NORTH END	LBM	10	6° 41′ 48″ 121° 42′ 36″	
MZ 19	MATANAL Pt.	LBM	10	6° 37′ 28″ 122° 19′ 36″	
MZ 20	MANADI I.	LBS	5	12° 19′ 45″ 121° 02′ 34″	
MZ 21	DONGON REEF	LBS	5	12° 19′ 00″ 121° 00′ 15″	
MZ 22	SECO I.	LBS	5	11° 19′ 16″ 121° 39′ 45″	
MZ 23	SOMBRERO Rk.	LBS	5	10° 43′ 15″ 121° 33′ 00″	
MZ 24	BATUPARE Pt.	LBS	5	6° 45′ 12″ 122° 04′ 05″	
MZ 25	KALUITAN I.	LBS	5	6° 35′ 36″ 121° 46′ 42″	
MZ 26	GREAT GOUNAN I. EAST END	LBS	5	6° 33′ 00″ 121° 51′ 56″	
MZ 27	ILIN STRAIT SOUTH ENTRANCE	RLB	5	12° 14′ 30″ 121° 06′ 26″	
MZ 28	BASILAN	RLB	5	6° 42′ 22″ 121° 57′ 09″	
MZ 29	ZAMBOANGA No.2	B	5	6° 53′ 55″ 122° 04′ 42″	
MZ 30	SANTA CRUZ BANK NORTH	B	5	6° 53′ 49″ 122° 00′ 33″	
MZ 31	SANTA CRUZ BANK WEST	B	5	6° 52′ 50″ 121° 59′ 04″	
MZ 32	SANTA CRUZ BANK EAST	B	5	6° 52′ 25″ 122° 05′ 04″	
MZ 33	SANTA CRUZ BANK SOUTH	B	5	6° 51′ 15″ 122° 04′ 05″	
ZD 1	FLECHA Pt.	LH	20	7° 21′ 35″ 123° 24′ 05″	
ZD 2	QUIDAPIL Pt.	LH	20	6° 49′ 25″ 123° 55′ 45″	
ZD 3	PALIMBANG Pt.	LH	20	6° 11′ 50″ 124° 10′ 30″	
ZD 4	BAIS Pt.	LBL	15	6° 39′ 45″ 126° 04′ 12″	
ZD 5	TUBALAN HEAD	LBL	15	6° 28′ 40″ 125° 35′ 30″	
ZD 6	BUCA Pt.	LBL	15	5° 57′ 30″ 124° 40′ 24″	

No	Location	Type	Range N.M.	Position	Remarks
T 10	MALAGINING Pt.	LBM	10	11° 28′ 02″ 124° 50′ 20″	
T 11	SAN ANDRES I. NORTH EAST END	LBS	5	12° 24′ 30″ 124° 02′ 00″	
T 12	ESCARPADA I. EAST END	LBS	5	12° 22′ 15″ 124° 04′ 40″	
T 13	MINANGA Pt.	LBS	5	12° 21′ 30″ 124° 16′ 30″	
T 14	TABANTALAN Pt.	LBS	5	12° 16′ 30″ 124° 06′ 30″	
T 15	OLO Pt.	LBS	5	11° 53′ 30″ 124° 28′ 00″	
T 16	DANAODANA I.	LBS	5	11° 44′ 05″ 124° 42′ 48″	
T 17	NAPARICAN Pt.	LBS	5	11° 34′ 40″ 124° 46′ 00″	
T 18	NAVAL PIER	LBS	5	11° 33′ 36″ 124° 23′ 15″	
T 19	TACLOBAN LEADING LIGHT No.1	LL		11° 25′ 15″ 124° 54′ 26″	
T 20	TACLOBAN LEADING LIGHT No.2	LL		11° 25′ 15″ 124° 54′ 26″	
T 21	MASBATE ENTRANCE	B	5	12° 23′ 13″ 123° 36′ 41″	
T 22	MASBATE No.1	B	5	12° 22′ 36″ 123° 36′ 40″	
T 23	TACLOBAN NORTH No.1	B	5	11° 27′ 12″ 124° 53′ 08″	
T 24	TACLOBAN NORTH No.2	B	5	11° 25′ 38″ 124° 57′ 21″	
T 25	TACLOBAN NORTH No.3	B or LBS	5	11° 22′ 12″ 124° 58′ 57″	
T 26	TACLOBAN NORTH No.5	B	5	11° 20′ 37″ 124° 58′ 47″	
T 27	TACLOBAN NORTH No.6	B	5	11° 16′ 42″ 124° 58′ 42″	
T 28	BINATAC Pt.	B or LBS	5	11° 16′ 12″ 125° 00′ 21″	
T 29	TACLOBAN SOUTH No.12	B	5	11° 12′ 17″ 125° 04′ 04″	
T 30	TACLOBAN SOUTH No.11	B	5	11° 12′ 12″ 125° 03′ 34″	
T 31	TACLOBAN SOUTH No.10	B	5	11° 10′ 10″ 125° 04′ 24″	
T 32	TACLOBAN SOUTH No.9	B	5	11° 10′ 05″ 125° 03′ 54″	
T 33	TACLOBAN SOUTH No.8	B	5	11° 07′ 52″ 125° 04′ 47″	
T 34	TACLOBAN SOUTH No7	B	5	11° 07′ 31″ 125° 04′ 19″	
T 35	TACLOBAN SOUTH No.6	B	5	11° 06′ 40″ 125° 07′ 53″	
T 36	TACLOBAN SOUTH II No.1	B	5	11° 06′ 25″ 125° 11′ 41″	

No	Location	Type	Range N.M.	Position	Remarks
ZD 7	BANOS Pt.	LBL	15	5° 55′ 30″ 125° 39′ 30″	
ZD 8	SUMBANG Pt.	LBL	15	5° 50′ 00″ 125° 10′ 05″	
ZD 9	OLANIVAN I.	LBL	15	5° 30′ 30″ 125° 29′ 15″	
ZD 10	TAGALO Pt.	LBM	10	7° 43′ 40″ 123° 28′ 40″	
ZD 11	LINGUISAN Pt.	LBM	10	7° 30′ 10″ 122° 26′ 10″	
ZD 12	SALATAN Pt.	LBM	10	7° 17′ 55″ 124° 01′ 40″	
ZD 13	LUTANGAN Pt.	LBM	10	7° 16′ 15″ 122° 50′ 52″	
ZD 14	PISO Pt.	LBM	10	7° 03′ 00″ 125° 56′ 59″	
ZD 15	MALABANG	LBS	5	7° 36′ 00″ 124° 02′ 50″	
ZD 16	PANDALUSAN I.	LBS	5	7° 27′ 50″ 122° 41′ 25″	
ZD 17	TAGUISIAN Pt.	LBS	5	7° 21′ 50″ 122° 58′ 20″	
ZD 18	MARIGABATO Pt.	LBS	5	7° 21′ 10″ 124° 12′ 10″	
ZD 19	KOPIA I.	LBS	5	7° 16′ 28″ 125° 49′ 37″	
ZD 20	LANSON Pt.	LBS	5	6° 04′ 10″ 125° 09′ 10″	
ZD 21	NIPANIPA I.	RLB	5	7° 36′ 40″ 123° 04′ 50″	
ZD 22	DAVAO No.1	B	5	7° 06′ 50″ 125° 39′ 20″	
ZD 23	DAVAO No.2	B	5	7° 05′ 35″ 125° 39′ 10″	
ZD 24	DAVAO No.3	B	5	7° 05′ 00″ 125° 38′ 40″	
ZD 25	DAVAO No.4	B	5	7° 04′ 00″ 125° 37′ 30″	
ZD 26	DAVAO No.5	B	5	7° 03′ 05″ 125° 36′ 40″	
ZD 27	DAVAO No.6	B	5	7° 02′ 20″ 125° 36′ 15″	
ZB 1	DAINGAPIC Pt.	LH	20	6° 05′ 12″ 121° 00′ 54″	
ZB 2	TAMPAT Pt.	LH	20	5° 01′ 00″ 119° 44′ 25″	
ZB 3	WEST BOLOD I.	LBL	15	6° 15′ 00″ 121° 35′ 30″	
ZB 4	DAMMAI I.	LBL	15	5° 46′ 30″ 120° 25′ 00″	
ZB 5	BACUNG Pt.	LBL	15	5° 14′ 10″ 119° 58′ 40″	
ZB 6	SULADE I. NORTH END	LBM	10	5° 50′ 30″ 120° 46′ 50″	

No	Location	Type	Range N.M.	Position	Remarks
ZB 7	KANG TIPAYAN DAPULA I.	LBM	10	5° 27′ 40″ 120° 13′ 50″	
ZB 8	SIBUTU I. NORTH END	LBM	10	4° 54′ 10″ 119° 27′ 10″	
ZB 9	USADA I. EAST END	LBS	5	6° 07′ 30″ 120° 32′ 20″	
ZB 10	CAPUAL I. WEST END	LBS	5	6° 02′ 15″ 121° 22′ 45″	
ZB 11	LAPAC I. NORTH END	LBS	5	5° 34′ 10″ 120° 47′ 35″	
ZB 12	MALAKA Pt.	LBS	5	5° 03′ 39″ 119° 52′ 53″	
ZB 13	SANGASIAPU I. EAST END	LBS	5	4° 57′ 24″ 119° 50′ 25″	
MP 1	TINITIAN Pt.	LH	20	10° 03′ 10″ 119° 11′ 50″	
MP 2	BANTAC I. NORTH EAST END	LBL	15	12° 13′ 30″ 120° 23′ 20″	
MP 3	SALIMBUBUC I.	LBL	15	11° 17′ 30″ 120° 14′ 00″	
MP 4	CALIS Pt.	LBM	10	11° 48′ 40″ 120° 15′ 50″	
MP 5	DICABAITO I. SOUTH END	LBM	10	11° 38′ 00″ 119° 58′ 00″	
MP 6	GREEN I.	LBM	10	10° 16′ 20″ 119° 29′ 40″	
MP 7	MALANAO I.	LBM	10	9° 26′ 15″ 118° 37′ 30″	
MP 8	MALCAPUYA I.	LBS	5	11° 47′ 15″ 120° 06′ 20″	
MP 9	CABULAUAN I.	LBS	5	11° 23′ 30″ 120° 04′ 50″	
MP 10	DEBANGAN I.	LBS	5	11° 01′ 40″ 119° 44′ 10″	
MP 11	ESFUERZO Pt.	LBS	5	10° 31′ 45″ 119° 42′ 40″	
T 1	CAPINES Pt.	LH	20	11° 05′ 12″ 125° 14′ 00″	
T 2	AMAMBAHAG Pt.	LBL	15	11° 40′ 30″ 124° 32′ 05″	
T 3	HANDIG Pt.	LBL	15	10° 44′ 24″ 125° 41′ 33″	
T 4	GUINDUGANAN Pt.	LBM	10	13° 01′ 45″ 122° 57′ 00″	
T 5	MALAPINGAN Pt.	LBM	10	12° 50′ 30″ 123° 12′ 00″	
T 6	AGUJA Pt.	LBM	10	12° 42′ 00″ 123° 23′ 00″	
T 7	TIMON Pt.	LBM	10	12° 23′ 00″ 124° 11′ 00″	
T 8	BALALAKI Pt.	LBM	10	12° 04′ 45″ 124° 13′ 50″	
T 9	CAMANDAD I. NORTH EAST END	LBM	10	11° 59′ 20″ 124° 25′ 40″	