NO.

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

DIRECTORATE GENERAL OF SEA COMMUNICATION, MINISTRY OF COMMUNICATIONS (DGSC), THE REPUBLIC OF INDONESIA

THE STUDY FOR THE MARITIME TRAFFIC SAFETY SYSTEM DEVELOPMENT PLAN IN THE REPUBLIC OF INDONESIA

FINAL REPORT

SUMMARY

June 2002

THE JAPAN ASSOCIATION OF MARINE SAFETY (JAMS)

JAPAN AIDS TO NAVIGATION ASSOCIATION (JANA)

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Exchange Rate in the Study:

1 US$ = Rp. 10,000 = 130 Japanese Yen

(based on the approximate mean rates during February 2002)

PREFACE

In response to a request from the Government of the Republic of Indonesia, the Government of Japan decided to conduct a study on Maritime Traffic Safety System Development Plan in the Republic of Indonesia and entrusted the study to Japan International Cooperation Agency.

JICA selected and dispatched a study team headed by Mr. Kunio Tashima (until September 4th 2001) of The Japan Association of Marine Safety (JAMS) and Mr. Shingo Tsuda (from September 5th 2001) of JAMS, to Indonesia, three times between April 2001 and March 2002. In addition, JICA set up an advisory committee headed by Mr. Tamotsu Ikeda (Director, Radio Aids Division, Aids to Navigation Department, Japan Coast Guard) between March 2001 and March 2002, which examined the study from specialist and technical points of view.

The team held discussions with the officials concerned of the Government of the Republic of Indonesia and conducted field surveys at study areas. Upon returning to Japan, the team conducted further studies and prepared this Final Report.

I hope that this report will contribute to the promotion of the projects and to the enhancement of friendly relationship between the two countries.

Finally, I wish to express my sincere appreciation to the officials concerned with the Government of the Republic of Indonesia for their close cooperation extended to the study.

June 2002

Takao Kawakami
President,
Japan International Cooperation Agency

LETTER OF TRANSMITTAL

June 2002
Mr. Takao Kawakami
President
Japan International Cooperation Agency

Dear Mr. Kawakami

It is my great pleasure to submit herewith the Final Report of the Study for the Maritime Traffic Safety System Development Plan in the Republic of Indonesia.

The study team of the Japan Association of Maritime Safety (JAMS) and Japan Aids to Navigation Association (JANA) conducted surveys in the Republic of Indonesia over the period between April 2001 and March 2002 as per the contract with Japan International Cooperation Agency.

The findings of this study, which are compiled in this report, were fully discussed with the officials of the Ministry of Communications of the Indonesian Government and other authorities concerned to formulate the Maritime Traffic Safety System Development Plan in the Republic of Indonesia for the period up to the year 2020.

On behalf of the study team, I would like to express my heartfelt appreciation to the Government of the Republic of Indonesia, the Ministry of Communications and other authorities concerned for their diligent cooperation and assistance and for the heartfelt hospitality which they extended to the study team during our stay in the Republic of Indonesia.

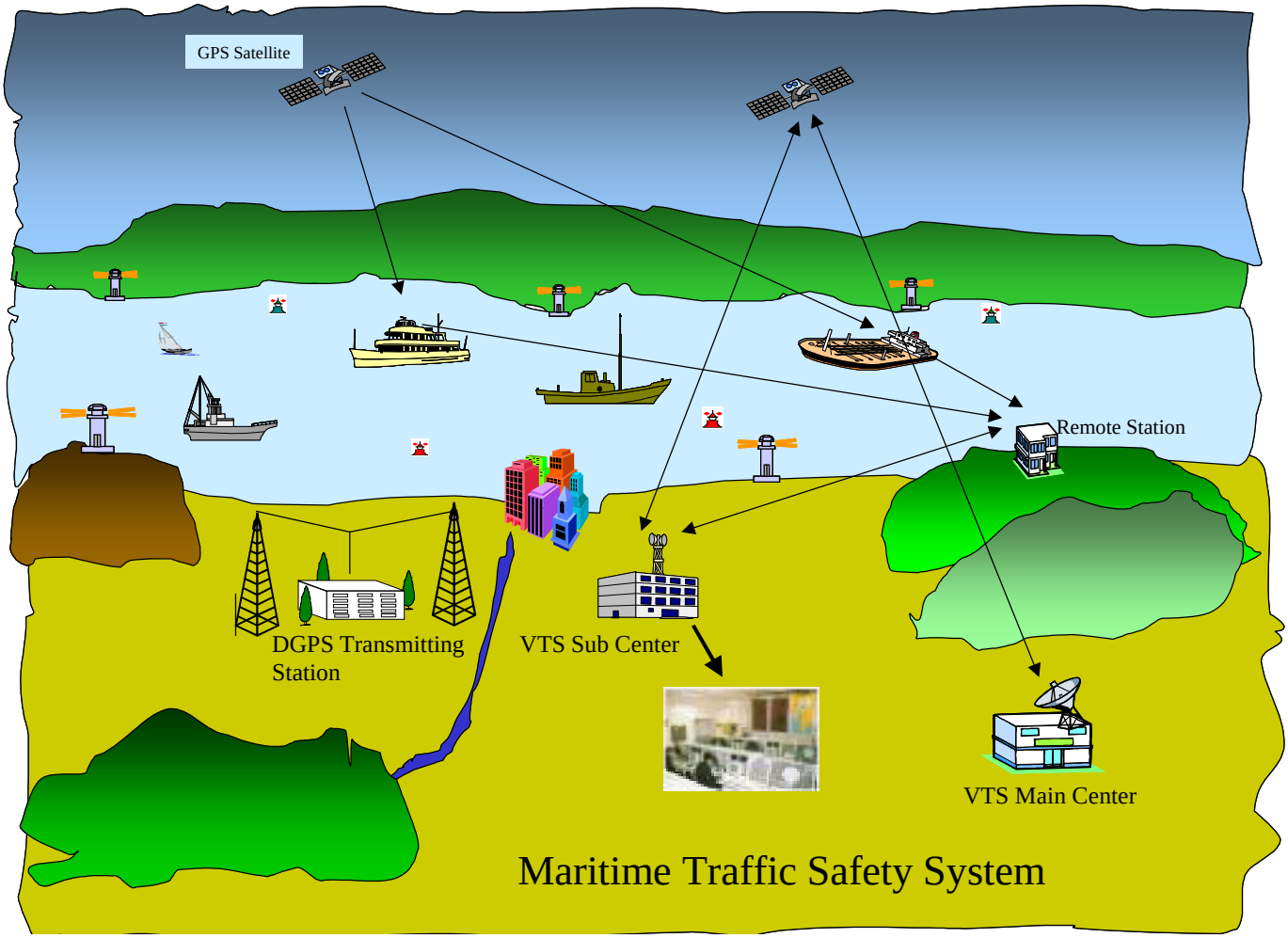
I am also deeply indebted to “Japan International Cooperation Agency”, “The Ministry of Foreign Affairs of Japan”, “The Ministry of Land, Infrastructure and Transport of Japan” and “Embassy of Japan in Indonesia” for giving us valuable suggestions and assistance during the preparation of this report.

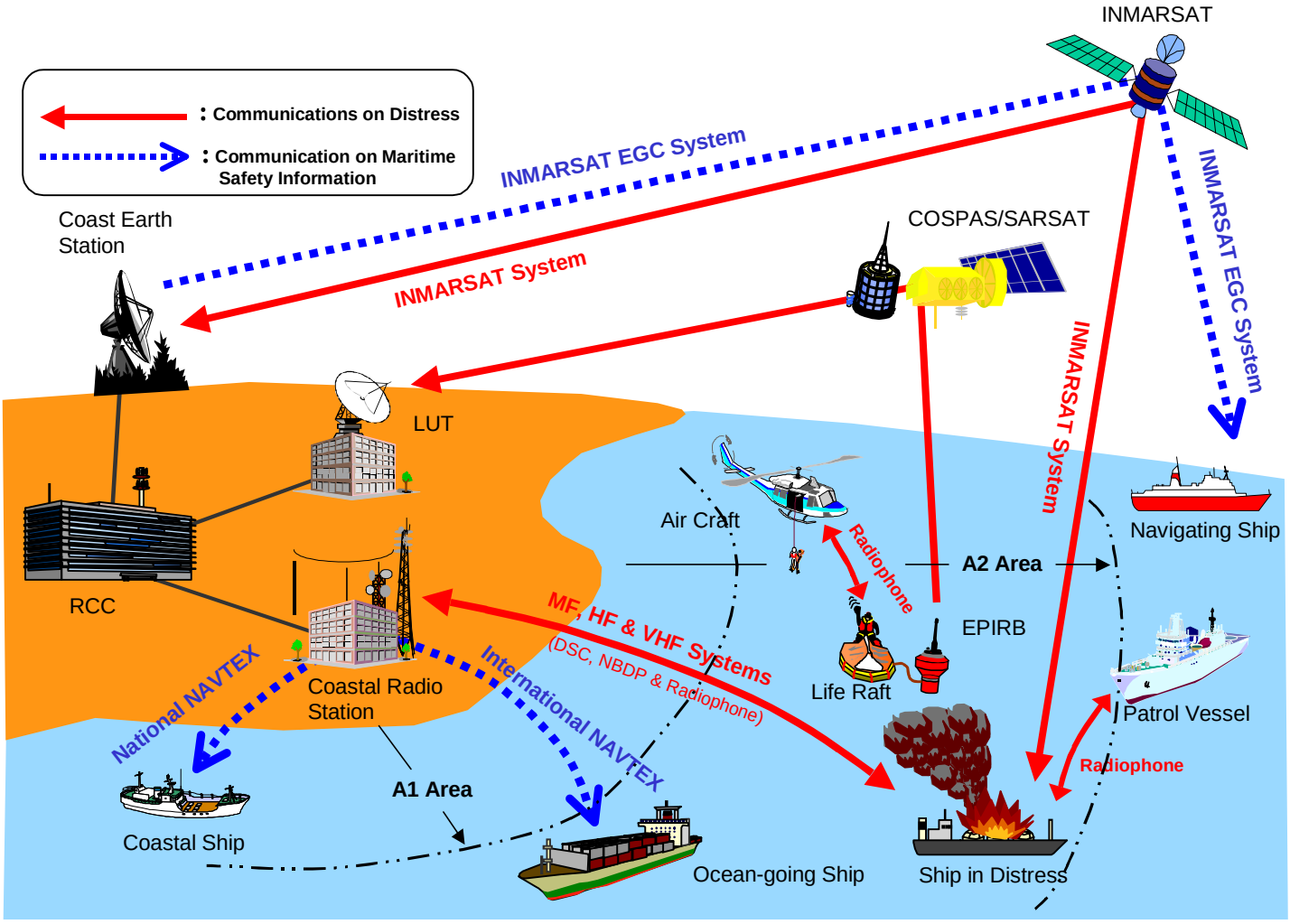
Yours faithfully,

津田眞吾

Shingo Tsuda
Team Leader,
The Study for the Maritime Traffic Safety System
Development Plan in the Republic of Indonesia

Concept of The Maritime Traffic Safety System Development Plan in the Republic of Indonesia





Major Indonesian Islands, Straits and Seas in the Study

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ABBREVIATION LIST

A	ADB	Asian Development Bank
	ADPEL	Administrator Pelabuhan (Port Administrator)
	ADSL	Asymmetric Digital Subscriber Line
	AIS	Automatic Identification System
	ALE	Automatic Link Establishment
	AMDAL	Environmental Impact Analysis
	AMVER	Automated Mutual-assistance Vessel Rescue System
	APBD	Anggaran Pendapadan Belanja Daerah / Area Income and Expenditure Estimate
	ARMADA PLP	Guard and Rescue Fleet
	ASDP	Angkutan Sungai Danau dan Penyeberangan (Ferry Transport Services)
B	BAKOSURTANAL	National Mapping and Survey Coordination Agency
	BAPEDAL	Environmental Impact Management Agency
	BAPPENAS	Badan Perencanaan Pembangunan Nasional National Development Planning Agency
	BAPPEDA	Badan Perencayaan Pembangunan Daerah / Institute of Province Development Plan
	BASARNAS	Badan SAR Nasional (National SAR Agency)
	BKN	Badan Kepegawaian Nasional / State Personnel Institution
	BOD	Biological Oxygen Demand
	BPS	Central Bureau of Statistics
	BTKP	Maritime Safety Technological Center
C	CBNA	Capacity Building Needs Assessment study
	CD-ROM	Compact Disk Read-only Memory
	CGI	Consultative Group on Indonesia
	CIDA	Canada International Assistance Agency
	CLGS	Community and Local Government Support
	COD	Chemical Oxygen Demand
	CS	Civil Society
D	DAK	Dana Alokasi Khusus / Special Allocation Fund
	DAU	Dana Alokasi Umum / General Allocation Fund
	DBS	Direct Broadcasting Service
	DC	Direct Current
	DC/DC	DC/DC Converter

	DGLC	Directorate General of Land Communication, Ministry of Communications
	DGNSS	Differential Global Navigation Satellite System
	DGPS	Differential Global Positioning System
	DGSC	Directorate General of Sea Communication, Ministry of Communications
	DISNAV	District Navigation Office
	DKI	Daerah Khusus Ibukota
	DM	Deutsche Mark(s)
	DPOD	Dewan Pertimbangan Otonomi Daerah / Local Autonomy Consulting Committee
	DSC	Digital Selective Call
	DSI	Number of List of Lights
	DWT	Dead Weight Tonnage
E	E/G	Engine Generator
	E/N	Exchange of Note
	EIRR	Economic Internal Rate of Return
F	FIRR	Financial Internal Rate of Return
G	GAMAT	Directorate of Guard and Rescue
	GBHN	Garis-garis Besar Haluan Negara (State Policy Guide Lines)
	GDP	Gross Domestic Product
	GEO	Geo-stationary Orbit
	GNP	Gross National Product
	GMDSS	Global Maritime Distress and Safety System
	GOI	Government of the Republic of Indonesia
	GOJ	Government of Japan
	GPS	Global Positioning System
	GRDP	Gross Regional Domestic Product
	GT	Gross Tonnage
	GTZ	Dautsche Gesellschaft fur Technische Zusammenarbeit
H	HBM	Harbor Master Office
	HF	High Frequency
I	IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
	IMO	International Maritime Organization
	IMF	International Monetary Fund
	IP	Internet Protocol
	IPC	Indonesia Port Corporation
	IPP	Independent Power Producer

	IT	Information Technology
	ITU	International Telecommunication Union
J	JAMS	The Japan Association of Marine Safety
	JANA	Japan Aids to Navigation Association
	JBIC	Japan Bank for International Cooperation
	JICA	Japan International Cooperation Agency
K	KANPEL	Kantor Pelabuhan (Port Office)
	KANWIL	District Office of Ministry of Communication
	KfW	Deutsche (German) Bank of Reconstruction
	KKN	Kolusi, Korupsi dan Nepotism / Collution, Corruption and Nepotism
	KM	Minister Decree
L	LAN	Lembaga Administrasi Negara / National Institute of Administration
	L/A	Loan Agreement
	lat. or Lat.	Latitude
	LH	Light House
	LOI	Letter of Intent
	long. or Long.	Longitude
	LOX	Local Exchanger
M	MEFP	Memorandum of Economic and Financial Policy
	MENPAN	Menteri Negara Pendayagunaan Aparatur Negara / State Minister for Utilization of State Apparatus
	MF	Medium Frequency
	MFB	Medium Wave Radio Beacon
	MOC	Ministry of Communications
	MSC	Maritime Safety Committee
	MOF	Ministry of Finance
	MP	Master Plan
N	NAVAREA	World-wide Navigation Warning Service Area
	NAVIGASI	Directorate of Navigation
	NAVTEX	Navigation Telex
	NBDP	Narrow Band Direct Printing
O	OJT	On the Job Training
	ODA	Official Development Assistance
P	P.	Pulau (Island)
	PAP	PT Angkasa Pura (Airport Corporation)
	PC	Personal Computer
	PCA	The People's Consultative Assembly

	PDPP	Program Daerah Pembangunan Perkotaan (Regional Program for City Development)
	PELNI	Pelayaran Nasional Indonesia (Indonesian National Shipping Lines)
	PELINDO	Indonesian Sea Port Corporation
	PLN	Perusahaan Listrik Negara
	PNBP	Non-Taxation State Revenue-Light Dues
	PP	Peraturan Pemerintah (Government Regulation)
	P/Q	Pre-qualification
	PROPENAS	National Development Program
	PT.	Perseroan Terbatas (Corporation)
	PUMDA	Pekerjaan Umum Daerah
	PUOD	Pemerintah Umum dan Otonomi Daerah
R	RACON	Radar Beacon
	REPELITA	National Five-year Development Plan
	RLB	Resilient Light Beacon
	Ro-Ro	Roll on Roll off type vessel
	Rp.	Rupiah
	RR	Radio Regulation
	RS	Reference Station
S	SA	Selective Availability
	SAPS	Special Assistance for Project Sustainability
	SAR	Search and Rescue
	SDP	Sector Development Program
	SFDM	Supprt for Decentralization Measures
	SISTRANS	The National Transport Development Plan
	SOLAS	IMO International Convention for the Safety of Life at Sea
	SROP	Coastal Radio Station
	SS	Solid Suspense
	SSB	Single Side Band
	STCW	International Convention on Standards of Training, Certificates and Watchkeeping for Seafarers
T	T/D	Tender Document(s)
	TEU	Twenty Foot Equivalent of Unit
	TG	Telegraph
	Tg.	Tanjung : Cape
	TLK	Teluk : Bay, Cove, Gulf
	TP	Telephone
	TSS	Traffic Separation Scheme

	TSSS	Transport Sector Strategy Study in Indonesia in 2000
	TX	Transmitting Station or Transmitter
U	Uj.	Ujung : top, Point
	U.K.	United Kingdom (of Great Britain and Northern Island)
	UKL	Environmental Management Effort
	ULCC	Ultra Large Crude oil Carrier
	UNCLOS	United Nations Convention of the Law of the Sea
	UNDP	United Nations Development Plan
	UPL	Environmental Monitoring Effort
	UPT	Technical Planning Unit
	USAID	United States Agency for International Development
V	VHF	Very High Frequency
	VLCC	Very Large Crude oil Carrier
	VSAT	Very Small Aperture Terminal
	VTIS	Vessel Traffic Information Services
	VTMS	Vessel Traffic Management Services
	VTS	Vessel Traffic Service
W	WARC	World Administration Radio Conference

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

I Background of the Study

The development and rehabilitation of the Maritime Traffic Safety System in the Republic of Indonesia have been carried out so far based on two JICA Master Plans with the target year of 2000. One is "Survey Report on Long Term Development Plan of Maritime Communication System in the Republic of Indonesia" published in March 1982 and the other is "The Master Plan on the Development of Aids to Navigation System in the Republic Indonesia" in October 1985.

Thereafter, there have arisen growing demands for the development, improvement and expansion of aids to navigation, along with the increase of maritime activities and the establishment of sea lanes in accordance with the United Nations Convention on the Law of the Sea (UNCLOS).

As for the Maritime Telecommunication System as well, it has become an urgent task to meet the international requirements such as SOLAS Convention.

Under these circumstances, GOI requested GOJ to formulate the Master Plans on the development and rehabilitation in the fields of Aids to Navigation and Maritime Telecommunication System.

Responding to the above request, JICA dispatched the Preparatory Study Team in November 2000, and organized the Study Team consisting of the Japan Association of Marine Safety and the Japan Aids to Navigation Association in March 2001. The Study Team started site surveys in April 2001.

II Current Situation

II-1 Current Situation of Indonesia

The Republic of Indonesia is one of the largest archipelagic states in the world consisting of some 17,500 islands covering 5,000 km from east to west and 2,000 km from north to south. It is also one of the greatest maritime countries in the world.

Maritime transportation is strategically very important for this country to facilitate the national development projects for the unification of the state all over.

For this purpose, the improvement and safety of maritime traffic routes are of great significance for the national land development and rehabilitation.

Indonesia has been recognized as an archipelagic State by UNCLOS since 1994, and Sea Lanes I, and have been designated as archipelagic sea lanes by IMO since May 1998. In addition, in December of the same year, the Traffic Separation Scheme in the Straits of Malacca and Singapore was extended to a total length of about 263 miles and at the same time, the mandatory Ship Reporting System in the Straits came into effect.

Taking these circumstances into consideration, development of aids to navigation and maritime telecommunication system should be studied hereafter.

In May 2000, the Light Dues System came into force and the collection started in June. The Light Dues are to be paid for the use of aids to navigation, maritime telecommunication and shipyard facilities.

The system is applied to vessels for international and internal navigation, passenger vessels and pioneer vessels navigating Indonesian territorial waters.

Under the system, a foreign vessel must pay US$0.027/GT, an Indonesian vessel must pay Rp.200/GT and a traditional vessel and a pioneer vessel must pay Rp.100/GT.

Up to 50% of the Light Dues revenue can be reused for the navigational services such as aids to navigation and maritime telecommunication system. The Light Dues collected during the period from January to December 2001 were equivalent to about 1,466 million Japanese Yen. The improvement of facilities for aids to navigation and maritime telecommunication system will be much expected hereafter by the introduction of the Light Dues System.

The centralization had been kept for 32 years under the Suharuto administration, but decentralization has been in progress since 1999. Diplomacy, defense and security, jurisdiction, currency and finance, and religion are to be still under the Central Government but other functions are to be shifted to local governments.

As for the fields of aids to navigation and maritime telecommunication system

to be studied this time, the Central Government is to implement related policies and basically there will be no changes.

II-2 Current Situation and Evaluation of Maritime Traffic Safety System

(1) Aids to Navigation

The current situation of visual aids to navigation is as follows:

	Managed by DGSC	Others
Lighthouse	235 units	----
Light beacon	1,168 units	437 units
Light buoy	332 units	396 units
Day mark	260 units	105 units
Buoy	103 units	45 units

As for the availability of visual aids to navigation, there are six District Navigation Offices whose availability is lower than 95% that is recommended by the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA). That is, their visual aids to navigation are not functioning effectively.

As for radio aids to navigation, 18 Medium Wave Radio Beacon (MFB) stations were constructed by Japanese loan aid but most of them had stopped their operation by 1996.

84 Radar Beacons mostly co-sited with lighthouses had stopped their operation except for only two units.

80 vessels for aids to navigation service are registered but 75 vessels are actually in operation. 53 vessels (70.7%) are over 26 years old and 58 vessels (77.3%) are in low functional condition of 80% or less.

(2) Maritime Telecommunication System

There are 221 coastal radio stations at present. GMDSS has already been introduced, but there still remain blind zones in the Indian Ocean, Banda Sea and Arafura Sea.

Four stations including Jakarta are carrying out the broadcasting of the International NAVTEX. The waters north of Sumatra is not covered by them but covered by stations of Singapore and Malaysia.

Considering these circumstances, it is not necessary to expand the International NAVTEX any more, but national NAVTEX in Indonesian language has not been set up yet.

As for internal communication system, equipment and facilities have become aged and old fashioned. They should be improved and upgraded step by step to meet the DGSC needs for information.

(3) Search and Rescue System

The Directorate of Guard and Rescue (GAMAT) of DGSC has primary responsibility for Search and Rescue (SAR) and carries out SAR activities under the coordination of the National Search and Rescue Agency (BASARNAS) of MOC.

BASARNAS asks the Marine Police, Navy, Air Force and the like for rescue activities, if necessary, and it coordinates overall search and rescue activities.

GAMAT has 107 patrol boats at 42 local offices all over the country. GAMAT also has 22 patrol boats of GAMAT Fleet under the direct command of the central headquarters, but only 9 of them can go out to the offshore waters. Their resources are far from sufficient to carry out their missions.

Furthermore, as the patrol boats are aged, not well maintained and so on, their operational rate is less than 30% of that originally planned.

(4) Education and Training

Education and training in the fields of aids to navigation and maritime telecommunication system have been given individually by DGSC, but they have not been carried out organizationally and systematically and staff's awareness of the necessity is low.

The Education and Training Agency is the integrated organization for overall education and training in MOC and gives training in the fields of maritime, land, air, meteorology, etc., but education and training in DGSC are not well coordinated with the Agency.

Ⅲ Development Plans

Ⅲ-1 Aids to Navigation

(1) Visual Aids to Navigation

Upon making plans, the followings are taken into consideration:

- Safety of international routes such as sea lanes approved by IMO,
- Recommendations and Guidelines by IALA and others,
- Marine accidents such as grounding and collision,
- Traffic routes for dangerous cargo vessels, passenger vessels and container carriers, and specified ports and harbors,
- Policies of GOI for ports and harbors,
- Aids to Navigation Development Plan in 1985,
- Navigational Safety Project in Indonesia by KfW
- Improvement of reliability and availability of aids to navigation, and
- Improvement of maintenance and management system.

Rehabilitation and Improvement Plans

About 20% of visual aids to navigation are in urgent need of rehabilitation. In order to achieve 95% availability required by IALA Recommendation and to improve reliability of mariners for aids to navigation, it is necessary to make rehabilitation plans as early as possible.

As for lighthouses and light beacons, priority is given to the followings: Unlit ones with troubles; ones that are estimated difficult to recover; ones that are marks for recognizing positions and turning points; and the like.

As for light buoys, as they are operated in accordance with the Regulation 13 of SOLAS Convention, all of them are planned to be rehabilitated together.

Plans for New Construction

New sites are planned according to the Recommendations and Guidelines as follows:

- The site showing a vessel a mark to recognize land, a main turning point or her position,
- The site showing a vessel location of a port, the entrance of a port, etc.,
- The site showing a vessel obstructions such as rocks and shoals and location of traffic routes,
- The site giving a vessel safe course at a narrow channel, the entrance of a port or a bay where vessel traffic is difficult,

- The site showing a vessel location of rocks, sunken rocks, shoals, etc. and traffic routes.

For the selected sites according to the above, the following items are evaluated with score based on the evaluation standards. The priority has been decided according to the evaluation:

- Strategic aspects such as sea lanes and international straits,
- Conditions of surrounding waters such as rocks, sunken rocks and offshore facilities,
- Situation of marine accidents in neighboring waters,
- Situation of maritime traffic routes of vessels such as tankers and passenger ships,
- Impact of serious accidents on environment such as resources for sightseeing and fishery,
- Policies of neighboring ports and harbors,
- Demands and forecast of traffic volume by waters,
- Demands of local communities, and
- Existence or non-existence of sites for aids tenders, buoy bases, buoy bodies, etc.

(2) Supporting Facilities

Aids to navigation of Indonesia, an archipelagic state, are built and operated at such places as are difficult to approach by land accesses. Vessels are indispensable means as supporting facilities.

At present, DGSC has 75 vessels, but nearly 70% of them are over 25 years old.

For this reason, development and rehabilitation of supporting vessels are planned in consideration of the followings:

- The scrapping plan of vessels by DGSC should be reviewed, because it is difficult for DGSC to build new vessels with its own budget within a short period.
- Regardless of the age, the operative vessels with comparatively good hulls and engines should be rehabilitated as early as possible and their lives should be extended.
- The District Navigation office that has more than one vessel should rearrange the deployment of them in terms of service quantity.

Ⅲ-2 Radio Aids to Navigation

(1) DGPS

For the planning of DGPS, the followings were taken into consideration:

- Sea lanes,
- DGPS in neighboring countries,
- AIS to be introduced in 2002,
- MFB Improvement Plan by JICA,
- Situation of infrastructure such as commercial power sources around the locations of DGPS stations
- Marine accidents such as grounding and collision
- Maritime traffic routes for dangerous cargo vessels, passenger vessels and container vessels
- Policies of GOI for ports and harbors
- Improvement of maintenance and management system

(2) Racon Stations

For the construction and rehabilitation of racon stations, such matters were taken into consideration as availability, land marks, marks for showing unremarkable shore lines, offshore structures and dangerous objects, traffic system and marks for turning points.

Ⅲ-3 VTS

VTS ensures the safety of waters and has a role of monitoring navigating vessels in the sea lanes. Foreign vessels are not allowed to navigate deviating from the sea lanes, but Indonesia has no systems to monitor movements of vessels at present.

Thinking about the above, VTS sites were selected based on the following standards, for the management of safe navigation in the three sea lanes:

- Entrances and exits of sea lanes necessary for the management of navigating vessels,
- The waters dangerous to vessel traffic with sunken rocks, etc. near the sea lane, or the waters approaching land in the sea lane,
- The waters around marine recreational facilities near the sea lane,
- The waters of busy vessel traffic where the sea lane and other traffic routes for such vessels as ferries are crossing, and
- The waters near the sea lane where marine accidents occur frequently.

The sites were further screened for the Short Term Plans based on the following

criteria:

- Strategic aspect of sea lane management,
- Vessel traffic safety,
- Environment protection,
- Actual situation of vessel traffic and the extent of congestion,
- Whether or not there are any relations with the existing VTMS (Malacca and Singapore Straits and Jakarta), and
- Number of passengers using vessels.

After the evaluation based on the above, Merak and Tanglad are selected for the Priority Project in consideration of the followings:

- Situation of marine accidents around the sea lanes,
- Preparing for the expansion of VTS all over the country in the future, convenient geographical places to access for the education and training of technological knowledge and skill,
- Cargo traffic volume in Sunda Strait and concentration of various kinds of plants around the Strait, and
- Marine resort areas around Lombok Strait.

Ⅲ-4 GMDSS

(1) Expansion and Improvement of GMDSS

It is necessary to establish Distress and Safety Communication System for Indonesian waters as early as possible for the following reasons:

① Introduction of GMDSS started in 1992 in accordance with the SOLAS Convention and to be completed by February 1999.

② There have been a lot of big marine accidents due to the poor telecommunication system in Indonesia.

③ It became an urgent task to cope with rampant piracies in Indonesian waters.

④ It is the premise that GMDSS should cover all the waters of the world without blind zones for Distress and Safety communication. It is necessary to cover all the waters of Indonesia.

Firstly, the Urgent Project is to cover blind zones of major waters and secondly, the Additional Plan will cover the remaining blind zones.

(2) NAVTEX

Firstly, National NATEX will start its operation using existing equipment, facilities and frequency, which have already been used for International NAVTEX as the Urgent Plan. Secondly, National NAVTEX will start using a

frequency exclusively used for it.

Ⅲ-5 Indonesia Ship Reporting System

The SAR Convention recommends that each party should establish Ship Reporting System in its Search and Rescue Region (SRR). It is also necessary for Indonesia to introduce the system in view of maritime safety and marine environment protection in its wide waters for the following reasons:

① The system is aiming at fundamental improvement of search and rescue system. The system has remarkably contributed to maritime safety in other countries. Especially in waters of the countries where SAR forces are poor, it has played a great role for the rescue of marine accidents.
② The reported data can be used for a wide variety of fields such as marine pollution prevention and anti-piracy activities.
③ DGSC vessels engaged in SAR and marine pollution prevention are very poor in quality and quantity. Assistance from many other navigating vessels is necessary.

The system should cover all the waters of Indonesian SRR. Fortunately, DGSC has a number of coastal radio stations all over the country. Utilizing these radio stations, the system will be introduced in a short period and with low costs.

In the First Phase, existing DSC/NBDP at major coastal radio stations are used, and AIS-VHF, which is compulsory for certain vessels from 2002, will be set up at 1st and 2nd class stations step by step.

In the Second Phase, AIS-VHF will be expanded to 3rd class stations and then long range AIS will be introduced as well. The long range AIS is to be put into practical use in the near future

Ⅲ-6 Telecommunication System

(1) Upgrading of Internal Communication Networks

The communication networks among major coastal radio stations and among offices are mainly depending on self-operated HF network owned by DGSC. The HF network using analog system is slow in speed and not suitable for data communication. To solve these problems, upgrading of Internal communication network is planned to meet the information needs of DGSC in the future.

The plan will be promoted in three phases with the hybrid system combining

existing infrastructure with new communication technology. This must be done well in consideration of the spread of Internet, development of satellite system, commercialization of digital HF, etc. in Indonesia. The plan was made as follows:

- 1st Phase for Internet/Existing analog HF,
- 2nd Phase for Internet/VSAT or digital HF, and
- 3rd Phase for Internet/VSAT.

(2) Integration and Improvement of Coastal Radio Stations

Each station is inefficiently operated independently due to the poor internal communication network. To improve this situation, upgrading plan of internal communication network and integration plan of coastal radio stations will be are promoted at the same time.

The radio communication equipments on board DGSC vessels will be digitalized.

In addition, for the communication equipments and facilities of various kinds, aged ones should be replaced and improved according to a proper schedule.

Ⅲ-7 Evaluation

(1) Selection of Priority Projects

The applicants for the Priority Projects are Aids to Navigation, DGPS, VTS, GMDSS, Ship Reporting System and Upgrading of Internal Communication Network. Feasibility Studies have been made for the above applicants and error measurement was done for GPS.

As a result, the following facts have been found:

① Rental fees for leased networks and satellite networks are still expensive.

② Commercialization of digital HF that is suitable for communications among coastal radio stations will take a few more years.

③ Internet that can be used for cheap fees spread over to local cities.

Considering these facts and the establishment of the Information Network using Internet for the piracy countermeasures, it came to a conclusion that the Upgrading of DGSC Internal Communication in 1st Phase should be promoted with a hybrid system under the combination of the existing HF and Internet.

Accordingly, the subject was put out of Feasibility Studies and decided to pick

up in each project as the need arises.

As for GPS, after the abolition of SA (Selective Availability), the accuracy has been improved to some 10 meters. According to the results of error measurement carried out from May 2001 to January 2002 in Indonesia, the mean static error became 10.5 meters. For this reason, DGPS should be utilized as a system for increasing positioning accuracy and reliability in the waters such as narrow channels and traffic congested waters where an accurate positioning is required.

Under the above circumstances and considering present traffic safety system and economic status in Indonesia, GMDSS that is mandatory under the Convention should have the first priority, followed by visual aids to navigation as a system of infrastructure for vessel traffic.

Compared with these, the urgency of DGPS has been judged low. Therefore, DGPS was put away from the Priority Projects and will be planned from year 2006 within the periods of the Short Term Plans.

Under these circumstances, the Priority Projects have been decided to be GMDSS, Aids to Navigation, VTS and Ship Reporting System.

(2) List for the Implementation Schedule and Costs is shown as follows:

Implementation Schedule and Estimated Cost

(Planned Year) (Million US$)

		LH:Light House, LBn: Light Beacon, LBy:Light Buoy	02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20	Cost
Aids to Navigation	**Master Plans (including Short Term Plan)**			**379.038**
	Visual Aids to Navigation	Rehabilitation（LH:35、LBn:231、LBy:61）		101.843
		New Development（LH:91、LBn:322、LBy:350）		
	Radio Aids to Navigation	New Develop. (DGPS Station:15, Monitoring Center:1)		32.100
		Rehabilitation and Improvement (Rader Beacon:50）		6.022
	Supporting Facilities	Vessels : Development 35,Rehabilitation 33 Development(Improvement) : Buoy Bases 15(9)、Open Storage 20(3)、Workshop 0(15)、Storage 4(0)、Jetty 10(4)		211.024
	VTS System	New Develop. (Main Center:1, S. Center: 2, Remote:16)		28.048
	Short Term Plans (including Proposed Priority Projects)			**158.468**
	Visual Aids to Navigation	Rehabilitation（LH:35、LBn:176、LBy:61）		32.649
		New Develop.（LH:18、LBn:61、LBy:125）		
	Radio Aids to Navigation	New Development (DGPS:3, Monitoring Center:1)		5.648
	Supporting Facilities	Vessels : Development 19, Rehabilitation 32 Development(Improvement) : Buoy Bases 6(4)、Open Storage 10(2)、Workshop 0(7)、Storage 4(0)、Jetty 1(4)		114.115
	VTS System	New Development（Sub Center: 2)		6.055
	Priority Projects			**30.922**
	Visual Aids to Navigation with Supporting Facilities	Rehabilitation（LH:21、LBn:131、LBy:61）		20.529
		New Develop.（LH:8、LBn:33、LBy:34）		
		Improvement (Buoy Bases:5、Workshop:3)		4.338
	VTS System	New Development（Sub Center: 2)		6.055
Telecommunications System	**Master Plans (including Short Term Plan)**			**173.725**
	GMDSS	Installation of MF DSC（29）		41.880
		Installation of VHF DSC (48）		
		Installation of National NAVTEX（5）		2.888
	Ship Reporting System	Installtion of Receiving Station (62)		4.126
		Installation of Report Sub Center（18）		10.741
		Installation of Ship Reporting Center（1）		3.003
	Telecomm. System	Upgrading of Internal Communication Network		4.900
		Integration of Coast Stations		30.000
		Upgrading of Radio Equipment for DGSC's Fleet		18.400
		Replacement aged Equipment and Facilities		57.787
	Short Term Plans (including Proposed Priority Projects)			**51.249**
	GMDSS	Installation of MF DSC（19）		22.014
		Installation of VHF DSC (33）		
		Installation of National NAVTEX（4）		
	Ship Reporting System	Installtion of Receiving Station (49)		11.448
		Installation of Report Sub Center（18）		
		Installation of Ship Reporting Center（1）		
	Tele. System	Replacement aged Equipment and Facilities		17.787
	Priority Projects			**51.249**
	GMDSS	Installation of MF DSC（19）		39.801
		Installation of VHF DSC (33）		
		Installation of National NAVTEX（4）		
		Replacement aged Equipment and Facilities		
	Ship Reporting System	Installtion of Receiving Station (49)		11.448
		Installation of Report Sub Center（18）		
		Installation of Ship Reporting Center（1）		
Master Plans	Total Cost			**552.763**
Short Term Plans	Total Cost			**209.717**
Priority Projects	Total Cost			**82.171**

Ⅳ Recommendations

As mentioned above, the Study Team has formulated the Maritime Traffic Safety System Development Plan. In order to promote the Plan effectively, the Study Team recommends the followings:

Ⅳ-1 Maintenance and Management System

Upon promoting each plan, it should be taken into consideration that many facilities and equipments of aids to navigation and maritime telecommunication system have been in trouble and their reliability has gone down because of aging, troubles, shortage of spare parts, etc. Main causes are as follows:

① Shortage of routine budget,
② Maintenance and management system without sufficient manuals,
③ Lack of technician with sufficient knowledge and skill,
④ Lack of public relations relating to aids to navigation,
⑤ Lack of communication among offices concerned, and
⑥ Lack of leadership.

In order to improve these situations, the followings are recommended:

① Improvement of Budgetary Situation

The routine budget is extremely in short. The light dues are expected to improve the situation, but at first it is necessary to make efforts to increase routine budget that have been widely reduced due to the economic crisis. It is also necessary to make efforts to use the budget efficiently with emphasis placed on important matters.

② Improvement of Maintenance and Management System

- Rearrangement of responsible areas of District Navigation Offices making the areas clear and considering distances of aids to navigation, workshops, positions of existing aids to navigation, etc.
- Sufficient supply of maintenance facilities and equipments
- Increase of personal computers and their peripheral devices
- Establishment of mailing system using Internet
- Maintenance of radio aids to navigation and VTS by technicians of coastal radio stations

③ Transfer of Technology

- Transfer of technology by JICA experts or aids to navigation experts

- Training at JICA facilities

Ⅳ-2 Education and Training

For the maintenance, management and operation of maritime traffic safety system, education and training is important to get basic knowledge and skill. Generally speaking, however, there does not seem to be clear awareness on the purpose of education and training. In particular, no visions for education and training from long-term viewpoints have been established.

As for an integrated education and training, the Education and Training Agency (ETA) plans, implements and evaluates. On the other hand, DGSC tries to make specific plans of its own for training.

To make these roles of two organizations clear, it is necessary to plan an integrated education and training system.

(1) Establishment of Integrated Education and Training System for Maritime Safety

As for the education and training in maritime field, the Maritime Education and Training Center under ETA is responsible for overall management, but most of the contents of the education and training are for seafarers.

Currently in Indonesia, improvements of aids to navigation and maritime telecommunication system are important tasks and such international systems as GMDSS and Ship Reporting System are being introduced.

In addition, there have arisen growing demands in and out of the country for urgent and integrated policies relating to maritime search and rescue system, countermeasures against piracies and drug trafficking and so forth.

It is effective for these policies to develop and promote as an integrated policy for maritime safety. To meet these demands, it is necessary to establish an integrated education and training system in the field of maritime safety.

(2) Other Recommendations

① Transfer of technology by those who had participated in training of various kinds

② Importance of OJT

③ Practical training upon the construction and installment of facilities and equipments

④ Training by experts visiting local facilities

⑤ Incentive or motivation – evaluation, promotion, qualification, etc.
⑥ Education and training for the new systems

Ⅳ-3 Traffic Safety System

The Study Team has formulated the Development Plan, but actual situation of Indonesia is that the functions of the installed facilities and equipments have been poorly maintained and operated. In order to properly and effectively operate each system to be developed under this Plan, the following measures should be taken as supplements to support the Plan.

(1) Grasp of Marine Accidents

In order to study proper measures to prevent marine accidents, it is necessary to grasp actual situations of all accidents, to make clear the cause of each accident and to analyze the trends of them.

(2) Establishment of Traffic Separation Scheme (TSS) in Sunda Strait

Sunda Strait is one of the most congested waters with vessel traffic in Indonesia. There are several complicated traffic flows. To decrease the danger of collision, it is necessary to put the traffic flows in order. Thereby TSS is recommended.

(3) Strengthening of SAR System

National Search and Rescue Agency has few field units for its own, so as a matter of fact, it is difficult for it to command and coordinate SAR forces on the scene. To function the Agency efficiently, it is desirable to strengthen its SAR coordination functions and to carry out SAR activities effectively under the close cooperation of the organizations concerned.

On the other hand, to solve the absolute shortage of SAR forces, it is necessary to implement the Master Plan on “Maritime Safety Plan concerning Search and Rescue in the Republic of Indonesia” in 1989 as early as possible and to have it approach the target of 2005.

In addition, to operate the limited SAR forces efficiently, the arrangement of stations where SAR forces are always ready in the vicinity of waters with frequent accidents, and the concentrated arrangement of SAR forces, should be studied.

(4) Survey of Actual Vessel Traffic Situation

In Indonesia, there are no organizations responsible for the surveys of actual

vessel traffic situation and the surveys have not been carried out at all until December 2001.

For the investigations of marine accidents, DGSC is responsible but they have not been carried out for all the accidents, and reporting system to the central organization had not been established yet.

In order to reflect on the measures to prevent marine accidents, it is necessary to grasp the situations of vessel traffic in the main traffic routes, narrow channels and the like, and to carry out vessel traffic surveys periodically and continually.

SUMMARY

PART 1

PRESENT STATUS, EVALUATION AND FUTURE DEMANDS

CHAPTER 1.
INTRODUCTION

1.1. Background of the Study

The development of aids to navigation and maritime telecommunications system in Indonesia has been implemented based on the master plans which were formulated in March 1982 and in October 1985 by JICA and, had covered up to year 2000.

Since then there have still been great demands for extension and improvement of aids to navigation coming from the sea lanes which were newly established according to UNCLOS and other vessel traffic routes as a result of steady increase of marine activities in Indonesia.

In this regard, GOI has been in need of the master plans of both fields of aids to navigation and maritime telecommunications systems as "**The Study for the Maritime Traffic Safety System Development Plan**" (hereinafter referred as "**the Study**") which covers up to the target year of 2020.

In response to the request of GOI, GOJ decided to conduct the Study on the Development Plan in accordance with the relevant international / internal laws and regulations in force in Indonesia .

JICA, which is the official agency responsible for the implementation of the technical cooperation programs of GOJ, sent Preliminary Survey Team in November 2000 to conclude the Scope of Work and its Minutes of Meeting, which were mutually agreed on November 13th 2000 between DGSC and JICA.

The JICA Study Team (hereinafter referred to as "the Study Team") was organized by JAMS and JANA in March 2001 and formulated Inception Report in advance of commencing implementation of the Study in Indonesia.

JICA dispatched the Study Team headed by Mr. Kunio TASHIMA to Indonesia on April 22nd 2001 to conduct the Study.

1.2. Objectives of the Study

The objectives of the Study are:

(1) To formulate the master plans for aids to navigation and maritime telecommunications system up to the target year of 2020;
(2) To formulate the short term plans up to the target year of 2007;
(3) To select priority projects from the short term plans and to implement feasibility studies for the selected projects;
(4) To make recommendations about education/training, operation / maintenance and other things related to the maritime traffic safety system;
(5) To transfer technology related to the Study through seminars and counterpart training.

1.3. Organization of Steering Committee and Counterparts

At the beginning of the Study, DGSC presented the Steering Committee and the Counterpart Members who were organized by related GOI officials.

1.4. Organization of the Study Team

The Study Team was comprised of Team Leader Mr. Kunio TASHIMA (relieved by Mr. Shigo TSUDA on Sept.5th 2001) and other 17 experts.

1.5. Governmental Organization Related to the Study

(1) Ministry of Communications

The existing Maritime Traffic Safety System in Indonesia is undertaken by DGSC under the Ministry of Communication (MOC).

MOC consists of 4 Directorate Generals and 3 Agencies and 1 Secretary General Bureau as of January 2002.

(2) DGSC

DGSC consists of the Secretary General and 5 Directorates as follows;

① Central Organization

a. Secretariat of Directorate General
b. Directorate of Navigation
c. Directorate of Guard and Rescue
d. Directorate of Marine Safety
e. Directorate of Ports & Dredging
f. Directorate of Traffic & Sea Transportation

② District Organization

Since 1988 (KM No.64/88), MOC had been represented by 27 regional offices known as **KANWIL** which contained technical implementation offices (UPT) for land, sea and air communications. These offices worked together with the port (PELINDO), airport (PAP) and ferry (ASDP) companies.

The position of **KANWIL** was abolished under the Law No.22/99 and it is understood that their functions will be undertaken by the provincial administrations.

a. Port Administor Office (ADPEL)

The port administration services are under the control of Port Administrator Office (ADPEL) that was one of the subordinate offices of abolished **KANWIL**, and the dedicated ports are under the control of Port Office (KANPEL). As of Dec., 2001, ADPEL and KANPEL are directly controlled by Central Government as a temporary step.

However, 4 ports, Tanjung Priok (Jakarta), Belawan (Medan), Surabaya and Ujun Pandang (Makassar) are directly controlled by Director General of Sea Communications as Port Administrator (ADPEL) of 1st class ports.

b. Fleet Bases (ARMADA PLP)

The rescue and security at sea (exclusive of ports) within the entire territory of Indonesia are maintained by 5 fleet bases (ARMADA PLP) at Tanjung Priok, Tanjung Uban, Surabaya, Ambon and Bitung.

c. District Navigation Office (Distrik Navigasi)

For the local administration of the Directorate Navigation, 24 District Navigation Offices (Distrik Navigasi) are established under the DGSC. Several functional groups of experts of visual aids to navigation, coastal radio stations, ship's crew and sea watchkeeping are stationed at each District Navigation Office. The coastal stations deployed in the entire country are keeping watch for distress signals.

d. National Search and Rescue Agency (BASARNAS)

BASARNAS consists of 19 rescue coordination centers (6 of Type A and 13 of Type B), which are coordinating SAR activities among related organizations in each district.

1.6. Progress of the Study

(1) Implementation Records during 1st Work in Indonesia

The 1st Work in Indonesia was actually commenced on April 22nd 2001. The contents of Inception Report were explained and discussed on the 1st Steering Committee Meeting held on April 23rd and 24th 2001.

The Study Team was divided into three teams of Marine Traffic Team, Aids to Navigation Team and Telecommunications Team. Each team was also divided into several groups and implemented site surveys accompanied by counterpart officers. The locations of site areas are shown in **Figure 1.1.**

The site survey areas were finally decided on whether they are allowed to visit or not by the Study Team based on the JICA's Safety Management Standard. Especially, visits to Sabang, Sibolga, Ambon, Jayapura, Solong and Merauke were cancelled or unplanned to implement site survey.

The contents of the Progress Report No.1 were explained and confirmed by the Counterpart Meeting held on July 11th 2001.

(2) Implementation Records during 1st Work in Japan

During this work period in Japan, the Study Team formulated the master plans up to year 2020 and the short term plans up to year 2007, then selected the priority projects from the short term plans and compiled Interim Report.

Mr. Kunio TASHIMA, leader of the Study Team, was relieved by **Mr. Shingo TSUDA** on the date of September 5th 2001 due to ex-leader's private affair.

(3) Implementation Records during 2nd Work in Indonesia

JICA sent most members of the Study Team headed by Mr. Shingo TSUDA to

Indonesia again on October 1st 2001 to continue the study.

The contents of the Interim Report were explained by the Study Team in the 2nd Steering Committee Meeting held on Oct. 3rd 2001.

After the approval of the six priority projects in the Steering Committee, the Study Team prepared Inception Reports for each priority project upon request from GOI. The Counterpart Meeting was held on October 9th 2001 and discussed the contents of the Inception Reports of priority projects.

The Study Team started to implement the feasibility studies according to the Inception Reports of the 6 priority projects.

The Seminar No.1 was held jointly by JICA and DGSC on November 14th 2001. There was a total of 69 participants of Indonesian and Japanese including the Study Team members.

The 1st Counterpart Meeting on the Progress Report No.2 to discuss the contents related to telecommunications and educational matters was held on November 20th 2001 due to the restricted duration of the Study Team members concerned.

The 2nd Counterpart Meeting on the Progress Report No.2 was held on December 3rd 2001 to discuss the whole contents of the Progress Report No.2.

(4) Implementation Records during 2nd Work in Japan

The Study Team compiled the report as the Draft Final Report after reviewing the contents of Progress Report No.1 / No.2 and Interim Report.

(5) Implementation Records during 3rd Work in Indonesia

JICA sent a total of 9 members of the Study Team headed by Mr.Shingo TSUDA to Indonesia again on March 10th 2002 to continue the Study.

The contents of the Draft Final Report were explained by the Study Team in the 3rd Steering Committee Meeting held on March 13th 2002

The Seminar No.2 was held jointly by JICA and DGSC on March 20th 2002 at SRIWAJAYA Meeting Room in DGSC.

(6) Implementation Records during 3rd Work in Japan

During 3rd Work in Japan, the Draft Final Report was revised based on the request from GOI. The Study Team finalized the study work to compile the Final Report.

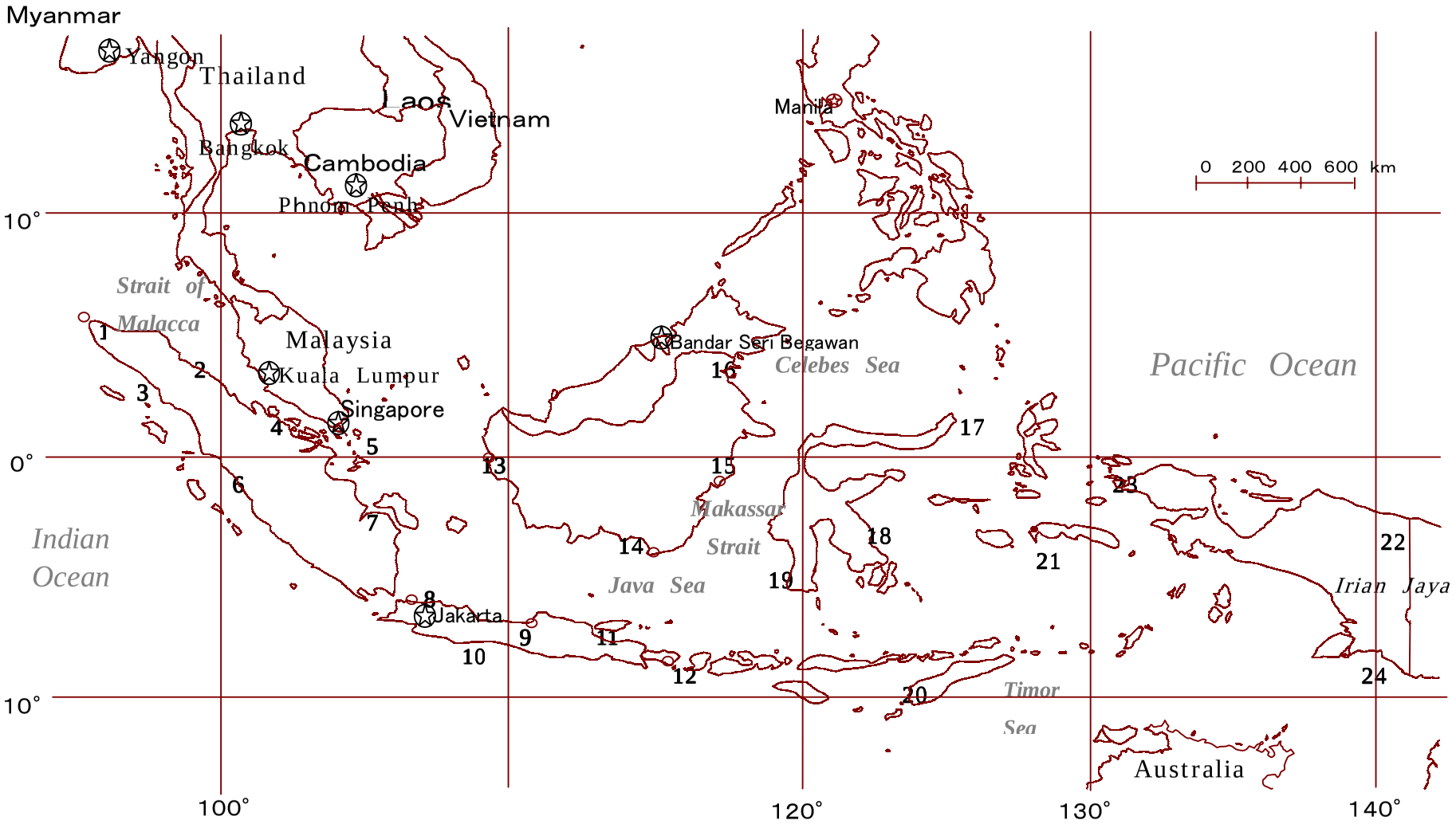
The study records up to the end of the Study are shown in **Figure 1.2.**

1.7. Entrusting to Local Consultants

Aiming at fast and smooth implementation of the Study, local consultants were entrusted with regards to following surveys:

- Establishment of Inventory for DGSC's Telecommunications Facilities;
- Establishment of Inventory for Aids to Navigation Facilities;
- GPS (including DGPS) Needs Survey;
- Environmental Assessment.

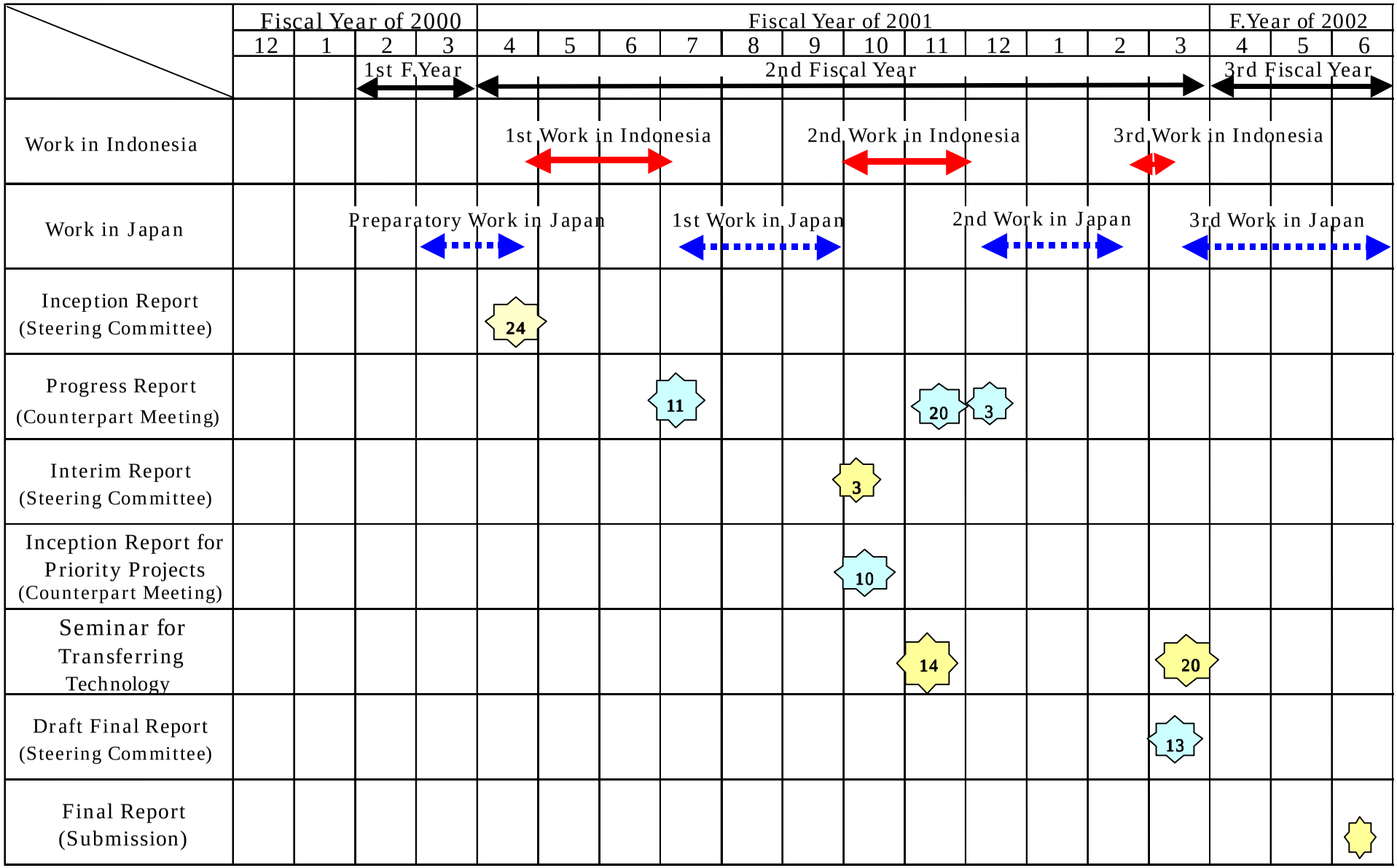
Figure 1.1. Location of Site Survey during 1st Work in Indonesia



1.Sabang	2.Belawan	3.Sibolga	4.Dumai	5.Tanjung. Pinang	6.Teluk. Bayur	7.Palembang	8.Tanjung. Priok
9.Semarang	10.Cilacap	11.Surabaya	12.Benoa	13.Pontianak	14.Banjarmasin	15.Samarinda	16.Tarakan
17.Manado/Bitung	18.Kendari	19.Ujung Pandang	20.Kupang	21.Ambon	22.Jayapura	23.Sorong	24.Merauke

Cancelled or Unplanned to visit

Figure 1.2. Implementation Record of the Study



CHAPTER 2. PRESENT STATUS

2.1. Socio-economic Conditions

2.1.1. National Economic Indices

(1) National income

National income grew 8.71 % in 1996, 3.31% in 1997, but sharply decreased -11.44 % in 1998 by economic and financial crisis. In 1999, it grew only 0.14 %. It is shown in **Table 2.1.1.**

Table 2.1.1. National Income

	1996	1997	1998	1999
National Income	358,151.6	370,020.5	327,693.7	328,151.9
Growth rate	8.71 %	3.31 %	-11.44 %	0.14 %

Unit: Billion Rupiah, Based on 1993 Constant Prices

Source: Statistic Year Book of Indonesia, 1999

(2) Production

GDP is generally used for showing the production of nation, therefore it shall be used in this report. GDP grew 7.5 % in 1994, 8.2 % in 1995, 7.8 % in 1996, 4.7 % in 1997, -13.1 % by economic crisis in 1998, 0.8 % in 1999, 4.8 % in 2000. GDP value from 1994 to 2000 is shown in **Table 2.1.2.**

Table 2.1.2. GDP at 1993 Constant Prices

	1994	1995	1996	1997	1998	1999*	2000**
GDP	354,640.8	383,792.3	413,797.9	433,245.9	376,374.9	379,557.7	397,666.3
Growth Rate	7.5 %	8.2 %	7.8 %	4.7 %	-13.1 %	0.8 %	4.8 %

Unit: GDP; Billion Rupiah, *; Preliminary Figure, **; Very Preliminary Figure

Source: 1) Statistic Year Book of Indonesia, 1999, BPS

2) Annual Report 2000, Bank of Indonesia

(3) Trade

The growth of export was still occupied by oil and gas up to 1986, since then production and export of non-oil commodities have improved and increased by new deregulation and policies. In 1998, the value of non-oil and gas export reached 83.88 % of the total export. But it dropped to 79.88 % in 1999 by economic crisis. At the same time, the total on value of Indonesian export decreased by 0.37 % comparing with 1998. The crisis also influenced the value of import. Since 1997, the value of import has been decreasing.

(4) Finance

A high fluctuation in the currency exchange rate during 1998-1999 had a negative impact on the government budget, led to the increased government expenditure exceeding government revenue. During the fiscal year 1998/1999, routine budget reached 152,810 billon rupiah. In the same fiscal year, routine expenditure reached 147,717 billion rupiah, of which the amount spent for interest and principal repayment of foreign debt was as much as 55,798 billion rupiah, which account for 37.8 % of the total expenditure.

2.1.2. Social Indices

(1) Population

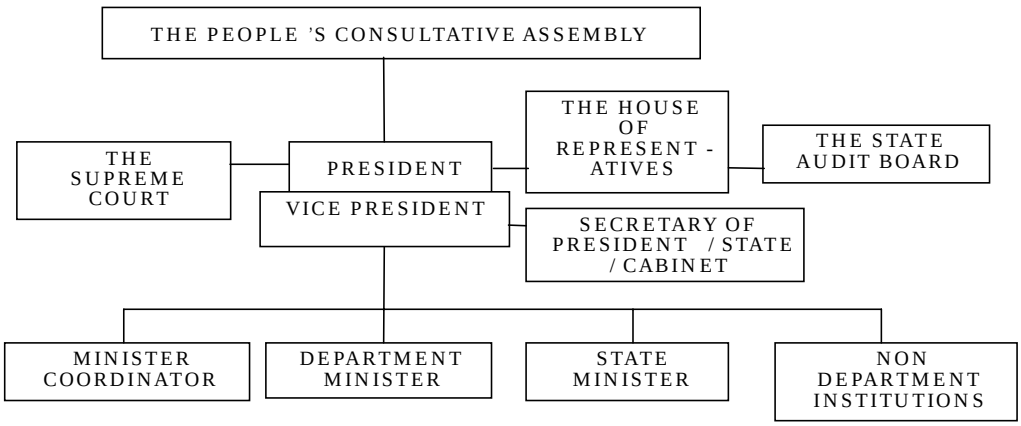
Indonesian population has some problems, such as the large number of population and their unequal distribution. The number of population in 2000 is projected at around 210.5 million and around 60 % of the whole population is concentrated in Java, although total area in Indonesia is only 7 %. Efforts to reduce population growth rate have been done by implementing family planning program since early 1970s.

2.1.3. Administrative Structure of National Government and Local Governments

(1) National Government

GOI is based on the constitution that was established in 1945. The Indonesian constitution of 1945 instituted a presidential system of government in the republic. The president is head of state, head of government, and commander in chief of the armed forces. The legislature is called the People's Consultative Assembly (PCA). The president is elected by PCA. It is shown **in Figure 2.1.1**.

Figure2.1.1. Administrative Structure of National Government (Megawati's Cabinet)



(2) Local Governments

The structure and organization of local governments follow the pattern of the national government. The Governor is the Chief Executive in the province and work with the staff of regional offices. The regional government in responsible for the regional legislation and decisions on the budget.

2.1.4. District Structure

There are 30 provinces, 261 districts, 70 cities in Indonesia.

2.1.5. Distribution of Industry and Economy (District-wise)

According to the Gross Regional Domestic Product (GRDP) 1999 by province at 1993 Constant Prices, the followings are clarified:

(1) Distribution of principal industries is Manufacturing (23.8 %), Trade, Restaurant & Hotel (18.5 %) and Agriculture (17.4%).

(2) Major production provinces in Manufacturing are West Java (23.1 %), East Java (16.1 %), DKI Jakarta (13.4 %) and Central Java (13.3 %).

(3) Major production provinces in Trade, Restaurant & Hotel are DKI Jakarta (19.0 %), West Java (17.0 %) and East Java (16.7 %).

(4) Major production provinces in Agriculture are East Java (15.1 %), West Java (13.8 %), Central Java (12.4 %) and North Sumatra (11.0 %).

(5) In Finance, Rent of Bldgs & Services are concentrated in DKI Jakarta (47.4 %).

2.1.6. National and Domestic Socio-economic Development Plan

For recovering from economic crisis, GOI consulted and agreed with IMF on Letter of Intent (LOI). A latest macro-economic policy has been managed by economic reform program stipulated in LOI. The State Policy Guide Line (GBHN) had been decided based on LOI in October 1999 and National Development Program (PROPENAS), which was established by GBHN, is new development plan replaced by “National Five Year Development Plan” (REPELITA) through 2000 to 2004. In the short term, macro-economic policy is directed at economic recovery. In line with the implementation of other policies, medium macro-economic policies are aiming at strengthening the base for sustainable and equitable development.

2.1.7. Land Transportation Industry and Sea-borne Industry

The economic and financial crisis has caused dramatic declines in transportation sector, especially road transport. Railway transport is found only in Java and Sumatra. It increased steadily comparing to road transport. Sea transport decreased temporarily in 1998, since then increased steadily.

The automobile industry were greatly shocked by the crisis.

2.1.8. Development Policy Regarding Land and Shipping Transportation

(1) Development Plan by PROPENAS

This is a new development plan that gives the development policy for land and shipping transportation facilities and infrastructure, in which the aims are to realize efficient, reliable transportation services, to realize an inter-mode national transportation system, to become parts of a distribution system that can provide services and benefits to the public at large and to increase adequate urban-rural network.

(2) Development Plan by Strategic Plan of Sea Transportation Development, DGSC

This is to establish the policy and strategy of sea transportation, in which the aims are to preserve capacity and quality of service of facility and an infrastructure, to keep proper services, to implement sea transportation service in the mechanism of regional autonomy support, to accomplish transportation service all over Indonesia, to improve productivity and performance, to keep fair competition atmosphere, to restructure funding system, to train human resources who are honest, qualified, professional, and responsible as well as competitive and to improve safety and security of sea transportation service, etc.

2.1.9. Commercial Energy Supply

Electricity has been mainly supplied by Perusahaan Listrik Negara (PLN) and the rest has been supplied by Independent Power Producer (IPP). The capacity of electric power generation of PLN is 60 % of whole Indonesian capacity. The demands for electricity had been increased between late 1960s and early 1990s. Since then, the demand for electricity had been decreased temporarily by the influence of economic and financial crisis. But, by economic recovery, the demands for electricity have been increased. The government plans to construct new electric infrastructures and build up existing facilities for that purpose. However, construction of new electric infrastructures is not taking shape now and construction of huge electric infrastructures is needed for 4-8 years. Therefore Shortage of electric power will appear on 2004.

2.2. Natural Conditions

The following statistical data of the natural conditions are obtained mostly from the British Admiralty Sailing Directions.

2.2.1. Climatic Conditions

Monthly climatic data complied from 10 to 30 year observations, 1945 to 1994 showing the following components from (1) to (10) at Jakarta, Surabaya, Palembang, Medan, Balikpapan, Banjarmasin, Ujungpandang, Manado, Kupang, Sorong and Merauke are collected.

(1) Average pressure at Mean Sea Level
(2) Temperatures
(3) Average humidity
(4) Average cloud cover
(5) Precipitation
(6) Wind distribution
(7) Mean wind speed
(8) Number of days with gale
(9) Number of days with fog
(10) Number of days with thunder

2.2.2. Geographical and Topographical Conditions

The following data and information about seabed conditions at 9 locations, sand wave conditions at Malacca Strait and other locations are collected.

(1) Seabed
① South east part of Malacca Strait
② North west part of Malacca Strait
③ South west coast of Sumatera
④ Sunda Shelf
⑤ North coast of Jawa
⑥ South of Jawa and Nusatenggara
⑦ Jawa Sea
⑧ South west of Kalimantan
⑨ Banda Sea

(2) Sand waves
① Malacca Strait
② Other areas

2.2.3. Current, Sea Level, Tide, Tidal Streams, Sea and Swell

(1) Current

Predominant current conditions in the following areas during the different seasons of the year are collected.

① Sumatera

② Jawa

③ Sulawesi, Nusatenggara

④ Irian Jaya

(2) Sea level, tide and tidal streams

① Sea level

Information about seasonal changes of sea level is collected.

② Tide

Information about characteristics of tide in the following areas is collected.

a. Malacca Strait

b. South west coast of Sumatera

c. Selat Sunda

d. North coast of Jawa

e. East coast of Sumatera

f. South and west coast of Kalimantan

g. Nusatenggara

h. Sulawesi

i. Irian Jaya

③ Tidal streams

Information about characteristics of tidal streams in the following areas is collected.

a. Malacca Strait

b. Sumatera, Jawa and SW Kalimantan

c. Jawa, Nusatenggara, Kalimantan and Sulawesi

d. Halmahera and Irian Jaya

(3) Sea and swell

Information about sea and swell conditions in the following locations is collected.

① Sea

a. Malacca Strait

b. Sumatera, Jawa and SW Kalimantan

c. Jawa, Nusatenggara, Kalimantan and Sulawesi

d. Halmahera and Irian Jaya

② Swell

a. Malacca Strait

b. Sumatera, Jawa and south west Kalimantan

c. Sumatera, Jawa and south west Kalimantan

d. Halmahera and Irian Jaya

2.2.4. Earthquake and Tsunami

(1) Earthquake

Information about characteristics of earthquake activities in Indonesia and data of destructive earthquakes in Indonesia from 1800 to 1998, and record of earthquakes with magnitude 5 richer and over in 1998 are collected.

(2) Tsunami

Information about characteristics of tsunami in Indonesia and data of tsunami activity in Indonesia during the period of 1600 ~ 1999 are collected.

2.3. Environmental Conditions

2.3.1. Laws and Regulations, etc. Related to Environmental Conservations

The following information related laws and regulations are collected.

(1) Legal basis of environmental conservation

(2) Environmentally related institutions

(3) National Development Program (PROPENAS) of 2000-2004

(4) Decree of the Minister of Communication No. KM4 and KM5 1996

2.3.2. Present Environmental Conditions

The following information related social, natural and pollution are collected.

(1) Social environment

Collected following statistical data.

① Population density by province

② Land utilization

a. Land utilization by province

b Land use certification by type of certification by province

c. Forest concession figures by province

③ Economic activities

a. Number of fishing households by province

b. Number of fishing households, fishing boats, fish cultured areas and quantity of productions by province

c. Fish culture areas by province and type of fish culture

d. Harvested area of paddy by province

e. Number of drilling well by company/island, location and type

(2) Natural environment

① National park and nature preservation, etc.

a. Number and area of land conservation by province

b. Number and area of marine conservation by province

c. Potential national park area by province, name, location and area of natural park by province

d. Name, location and area of grand forest park by province

e. Name, location and area of national park by province

f. Name, location and area of conservation area by province

g. Name, location and area of wild life conservation by province

h. Name, location and area of hunting park by province

i. List of fixed marine conservation area (excluding marine park) in several provinces

j. List of fixed conservation area (excluding marine park) in several provinces

k. Mangrove forest

② Valuable animals and plants

a. Number of species fauna protected for last 10 years
b. List of protected mammal
c. List of protected aves
d. List of protected reptilia List of protected orchidaceae, diputerocarpaceae, bivalvia, pisces and palmae
e. List of protected insect

(3) Environmental pollution

① Air pollution

a. Air pollution load from manufacturing industry by province
b. Air pollution load from constant source (fuel consumption) by province
c. Air pollution load from mobile source (fuel consumption) by province
d. Estimation of HC emission from motorized vehicle by province/island and type of vehicle
e. Estimation of NOx emission from motorized vehicle by province/island and type of vehicle
f. Estimation of CO emission from motorized vehicle by province/island and type of vehicle

② Water pollution

a. Liquid waste loading and water pollution by province and the pollutant
a. Monthly average concentration of Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD) and Solid Suspense (SS) parameter in river basin along of Sumatera Utara River by place of taking sample

2.4. Sea Lanes

2.4.1. Background of Sea Lanes

GOI decided to regulate the maritime traffic by defining three sea lanes in the straits and applied them to the IMO in August 1997. After the investigation in the IMO, they were adopted on May 19th 1998, in the Resolution MSC.72(69) titled "Adoption, Designation and Substitution of Archipelagic Sea Lanes" annexed with "Partial System of Archipelagic Sea Lanes in Indonesian Archipelagic Waters". The annex defines three sea lanes as Sea Lane I, II and III (A,B,C,D) in accordance with GOI's application as shown in **Figure 2.4.1**.

2.4.2. Covering Area of the Sea Lanes in Indonesian Waters

(1) The Straits of Malacca and Singapore

Malacca Strait and Singapore Strait together form the main seaway connecting the Indian Ocean with the China Sea. This seaway is also the shortest route for tankers trading between the Persian Gulf and Japan.

(2) Sea Lane I

The geographical positions of the Sea Lane I are defined in the Annex of MSC.72 (69) as the axis line from South China Sea to Indian (Hinda) Ocean through Natuna Sea, Karimata Strait, Western Java Sea and Sunda Strait.

(3) Sea Lane II

The geographical positions of the Sea Lane II are defined in the Annex of MSC.72(69) as the axis line from Celebes (Sulawesi) Sea to Indian (Hindia) Ocean through Makasar Strait and Lonbok Strait.

(4) Sea Lane III

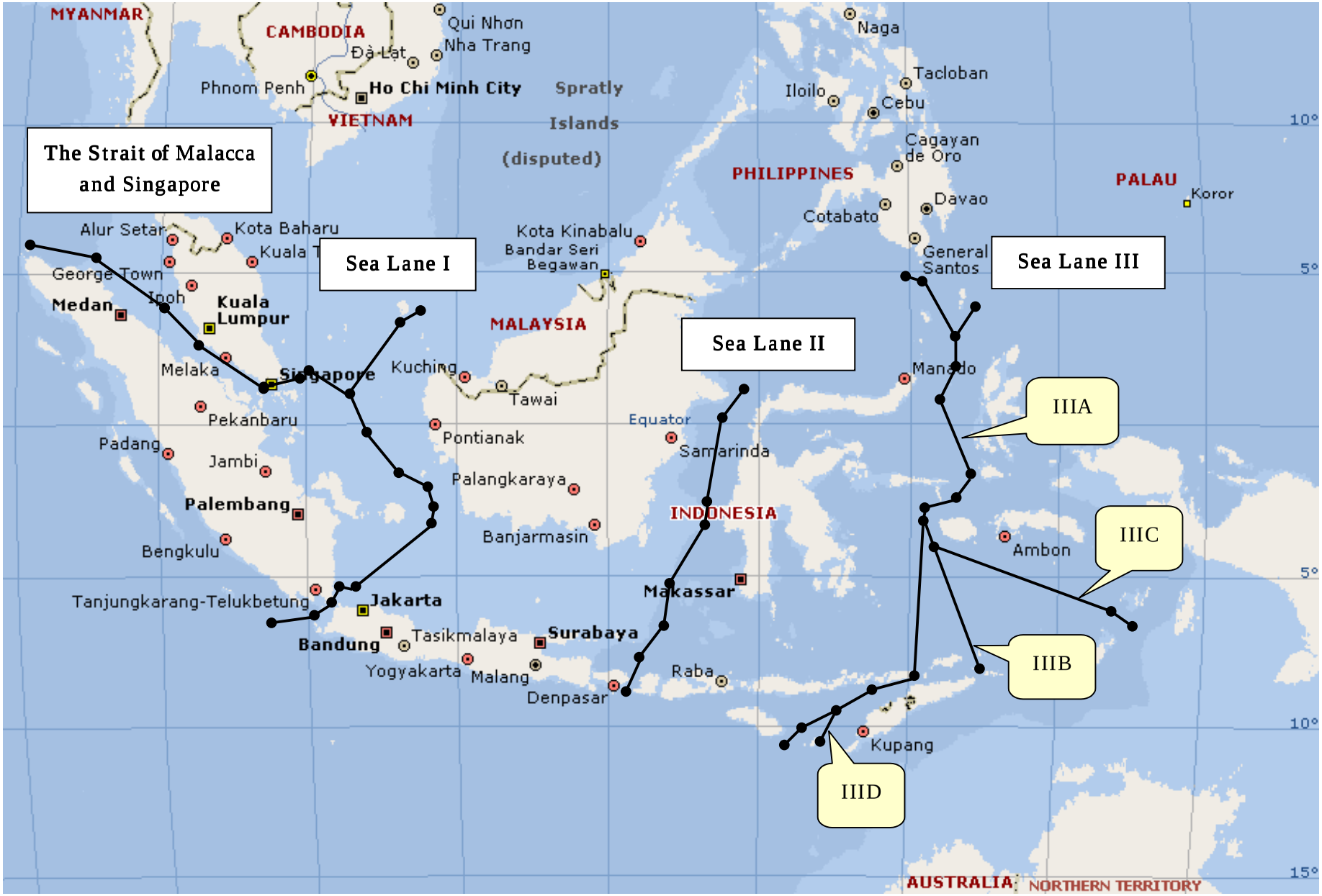
The geographical positions of the Sea Lane IIIA are defined in the Annex of MSC.72 (69) as the axis line from Pacific Ocean to Indian (Hindia) Ocean through Maluku Sea, Seram Sea, Banda Sea, Ombai Strait and Sawu Sea.

2.4.3. Marine Traffic Density in the Straits of Malacca and Singapore

Total reported vessels for the whole one year of 2000 to Klang VTS close to One Fathom Bank was 55,957. The largest number of the report was 18,283 (30.7%) from container vessels and the second was 13,343 (23.9%) from tankers.

A monthly number of reported vessels ranged from 4,000 to 5,000. On daily basis there were 153 reported vessels. If non-reporting vessels were included, it is estimated that there are more than **200** vessels on daily basis.

Figure 2.4.1. Archipelagic Sea Lanes in Indonesian Waters



2.4.4. Marine Traffic Density in Sea Lane I (Sunda Strait)

(1) 1st Marine Traffic Density Survey in Sunda Strait

As Sunda Strait is the narrowest strait in the Sea Lane I, the 1st density survey for marine traffic in Sunda Strait was carried out for continuous 48 hours from1400 local time on May 15th to the same local time on May 17th 2001.

The results of 1st Marine Traffic Density Survey in Sunda Strait are listed in **Table 2.4.1**.

Table 2.4.1. Result of 1st Density Survey for Continuous 48 Hours in Sunda Strait

1st Density Survey of Marine Traffic (From 1400hours May 15th to 1400hours Oct. 20th 2001)				Gate Line A Sunda Strait East Channel	Gate Line B Sunda Strait West Channel
Sunda Strait Northbound (48hours)	58	Tanker	9	5	4
		Cargo Boat	23	15	8
		Ferry Boat	0	0	0
		Fishing Boat	25	24	1
		Towing Vessel	1	1	0
Sunda Strait Southbound (48hours)	50	Tanker	5	4	1
		Cargo Boat	23	19	4
		Ferry Boat	4	3	1
		Fishing Boat	17	15	2
		Towing Vessel	1	0	1
				Gate Line A	Gate Line B
Total	108	Vessels		86	22

(2) 2nd Marine Traffic Density Survey in Sunda Strait

The 2nd marine traffic density survey in Sunda Strait was carried out for continuous 46 hours from 15:00 hours on Oct. 18th to 13:00 hours on Oct. 20th 2001. The result of the survey is shown in **Table 2.4.2.**

Table 2.4.2. Result of 2nd Density Survey for Continuous 46 Hours in Sunda Strait

2nd Density Survey of Marine Traffic (From 1500hours Oct. 18th to 1300hours Oct. 20th 2001)				Gate Line A Sunda Strait East Channel	Gate Line B Sunda Strait West Channel
Sunda Strait Northbound (46hours)	51	Tanker	5	4	1
		Cargo Boat	42	33	9
		Container Vessel	2	0	2
		Passenger Boat	0	0	0
		Fishing Boat	2	2	0
		Towing Vessel	0	0	0
Sunda Strait Southbound (46hours)	52	Tanker	10	9	1
		Cargo Boat	36	20	16
		Container Vessel	3	1	2
		Passenger Boat	2	1	1
		Fishing Boat	0	0	0
		Towing Vessel	1	1	0
				Gate Line A	Gate Line B
Total	103	Vessels		71	32

(3) Crossing Number by Ferry and High-speed Boats in Sunda Strait

The total number of marine traffic combined ferryboats and high-speed boats is **174 a day**. As the statistics of the actual crossing is about 10 percent less due to the continuous delay from the announced schedule, it is reasonable to use the figure of **156.6 a day**.

(4) Estimate of Daily Through-Traffic in Sunda Strait

① Estimate by the result of 1st Density Survey

The daily through-traffic in Sunda Strait based on 1st marine traffic density survey is estimated as follows;

Cargo Vessels	23 (including Bulkers)
Tankers	7
Passenger Boats	2
Fishing Boat	25
Others	1
Total	**58 traffics a day**

② Estimate by the result of 2nd Density Survey

The daily through-traffic in Sunda Strait based on 2nd marine traffic density survey is estimated as follows;

Cargo Vessels	40.7
Tankers	7.8
Containers	2.6
Passenger Boats	1.0
Fishing Boat	1.0
Others	0.5
Total	**53.6 traffics a day**

③ Estimate of Daily Traffic in Sunda Strait

The daily traffic in Sunda Strait except local fishing boats engaged in fishing operation through average result of 1st and 2nd marine traffic density survey is estimated as follows;

Through-Traffic	55.8
Ferryboat (Merak → Bakauheni)	156.6 (10% less than the schedule)
Others (Leisure Boat, etc.)	5
Total	**217.4 traffics a day**

2.4.5. Marine Traffic Density in Sea Lane II (Lombok Strait)

(1) Marine Traffic Density Survey in Lombok Strait

As Lombok Strait is the narrowest strait in the Sea Lane II, the density survey for marine traffic was carried out for continuous 48 hours started from

14:00 local time on May 18th until the same local time on May 20th 2001.

The result of the density survey is shown in **Table 2.4.3**.

Table 2.4.3. Result of Density Survey for Continuous 48 Hours in Lombok Strait

Lombok Strait Passing Through Vessel	Northbound	8	Tanker	2
			Bulker	6
			Fishing Vessel	0
	Southound	8	Tanker	2
			Bulker	5
			Fishing Vessel	1
Crossing Vessel	Ferry	51		
Badung Strait	Northbound	3		
	Southound	3		
	Total	**74**	Vessels	

(2) Container Vessel Traffic in Lombok Strait

Assuming that all the container traffics directly servicing between Singapore and Oceania pass the Lombok Strait, it comes to estimate of 74 traffics a month through "Internet and Indonesian Shipping Gazette" and is equivalent to **2.5** traffics a day.

(3) Ferryboats in Lombok Strait

There is a ferryboat service between Padangbai of Bali Island and Lembar of Lombok Island. The frequency of the ferryboat service are 16 departures from each port a day at an interval of 1.5 hours as of May 2001.

The statistics of ferryboat transportation in the route from Padangbai to Lembar in 2000 is listed in **Table 2.4.4**.

Table 2.4.4. Statistics of Ferryboat Transportation in 2000 (Padangbai – Lembar)

Items / Route	Number of Trip (Times)	Carried Passenger (Person)	Carried Vehicle (Units)
Padangbai - Lembar	11,086 / year **(30.4 / day)**	905,657 / year	206,528 / year

(4) Estimate of Daily Through-Traffic in Lombok Strait

The estimate of daily through-traffic of Lombok Strait under the 48 hour traffic survey and the reviewed result from the announced schedule are as follows;

Bulkers	6
Tankers	2
Containers	2.5
Ocean Going Fishing Boat	2
Total	**12.5 traffics a day**

(5) Estimate of Daily Traffic in Lombok Strait

The daily traffic in Lombok Strait except local fishing boats engaged in fishing operation is estimated as follows;

Through-Traffic	12.5
Ferryboat (Padangbai – Lembar)	30.4
Badung Strait (Port of Bunoa)	3
Others (Leisure Boat)	10
Total	**55..9 traffics a day**

2.4.6. Marine Traffic Density in Sea Lane III (Maluku Sea)

(1) Marine Traffic Density Survey in Sea Lane III, sea area between Mayu Island and Halmahera

The density survey for marine traffic between Mayu Island and Halmahera was carried out for continuous 48 hours started from 1200 local time on Oct.13th until the same local time on Oct.15th 2001.

The result of the survey is shown in **Table 2.4.5.**

Table 2.4.5. Result of Marine Traffic Density Survey in Maluku Sea for Continuous 48 Hours

Sea Lane III, Maluku Sea between Mayu Island and Halmahera	**Total 13 Vessels**	Northbound	9	Tanker	1
				Bulker	6
				Cargo Boat	2
		Southound	4	Tanker	0
				Bulker	4
				Cargo Boat	0
In the Vicinity of above area	**Total 2 Vessels**	Crossing Vessel	2	Bunker Barge	1
				Cargo Boat	1
		Local Fishing Boat	0		

Grand Total 15 Vessels

(2) Estimate of Traffic Quantity through Australian Route

The total quantity of passing through vessels in Sea Lane III on the route from the Pacific Ocean / the South China Sea to Australian ports was estimated **946.2 vessels a year** through the port statistics of Austrailian ports and it is equivalent to **2.59 vessels a day.**

Regarding LNG carriers having a regular service between North-west Australia and Japan, there are eight vessels in a round interval of 20 days as of January 2002. It is equivalent to about 36 trips a year per vessel and **0.79 trips a day** for the eight LNG carriers.

(3) Estimate of Daily Through Traffic in Maluku Sea of Sea Lane III between

Mayu Island and Halmahera by continuous 48 hour Density Survey

The quantity of daily through traffic in Maluku Sea of Sea Lane III is estimated through the Density Survey and LNG daily trip figure of 0.79 shall be added as never sighted during the Density Survey period.

Marine Traffic Density Survey	6.5
LNG Carrier (Australia – Japan)	0.79
Total	**7.29 traffics a day**

2.4.7. Summary of Daily Marine Through-Traffic Density in Year 2001

The estimated daily marine through-traffic density of each sea lane in year 2001 is summarized as follows;

(1) The Straits of Malacca and Singapore at One Fathom Bank

The total through-traffic is estimated about **200** vessels a day by the Klang VTS report as mentioned in **Section 2.4.3.**

(2) Sea Lane I

① Sunda Strait

It is estimated about **60** vessels a day based on the marine traffic density survey carried out by the JICA Study Team as mentioned in **Section 2.4.4.(4).**

② Karimata Strait

Weekly Indonesia Shipping Gazette shows the schedule of container vessels and feeder boats. The Study Team reviewed the number of through-traffic at Karimata Strait through the Gazette in the edition of May 14, May 21 and May 28, 2001. The number of through-traffic vessels was estimated about 250 for 45days, and it is equivalent to **6** vessels a day on the assumption that vessels from Singapore Strait or China Sea to Java Sea and vessel from China Sea to Jakarta would pass Karimata Strait.

Therefore, the daily density of through-traffic is estimated as follows:

Assumed 1/3(33.3%) from Sunda Strait	20 vessels
Estimated number of vessels from North Java, Makassar Strait by Indonesia Shipping Gazette	6 vessels
Other vessels	4 vessels
Total	**30 vessels**

(3) Sea Lane II

① Lombok Strait

It is estimated about **13** vessels a day based on the marine traffic density survey carried out by the Study Team as mentioned in **Section 2.4.5.(4).**

② Makassar Strait

It is estimated as follows;

Assumed 4/5(80%) from Lombok Strait	11 vessels

Assumed 1/10(10%) from Sea Lane III	1 vessel
Assumed 1/20(5%) from Sunda Strait	3 vessels
Assumed 1/10(10%) from Karimata Strait	3 vessels
Estimated vessels bound from North Java	2 vessel
Total	**20** vessels

(4) Sea Lane III

① IIIA(Maluku Sea between Mayu Island and Halmahera)

It is estimated about **8** vessels a day based on the marine traffic density survey carried out by the Study Team as mentioned in **Section 2.4.6.(4)**

② IIIC

It is estimated as follows;

Assumed 1/4(25%) from route IIIA	2 vessels
Estimated through Australian Route	1 vessel
Total	**3 vessels**

③ IIIB

Assumed 3/8(37.5%) from route IIIA	3 vessels
Estimated through Australian Route	1 vessel
Total	**4 vessels**

④ IIID

Assumed 3/8(37.5%) from route IIIA	3 vessels
Estimated through Australian Route	1 vessel
Total	**4 vessels**

(5) Summary of Through-Traffic Density

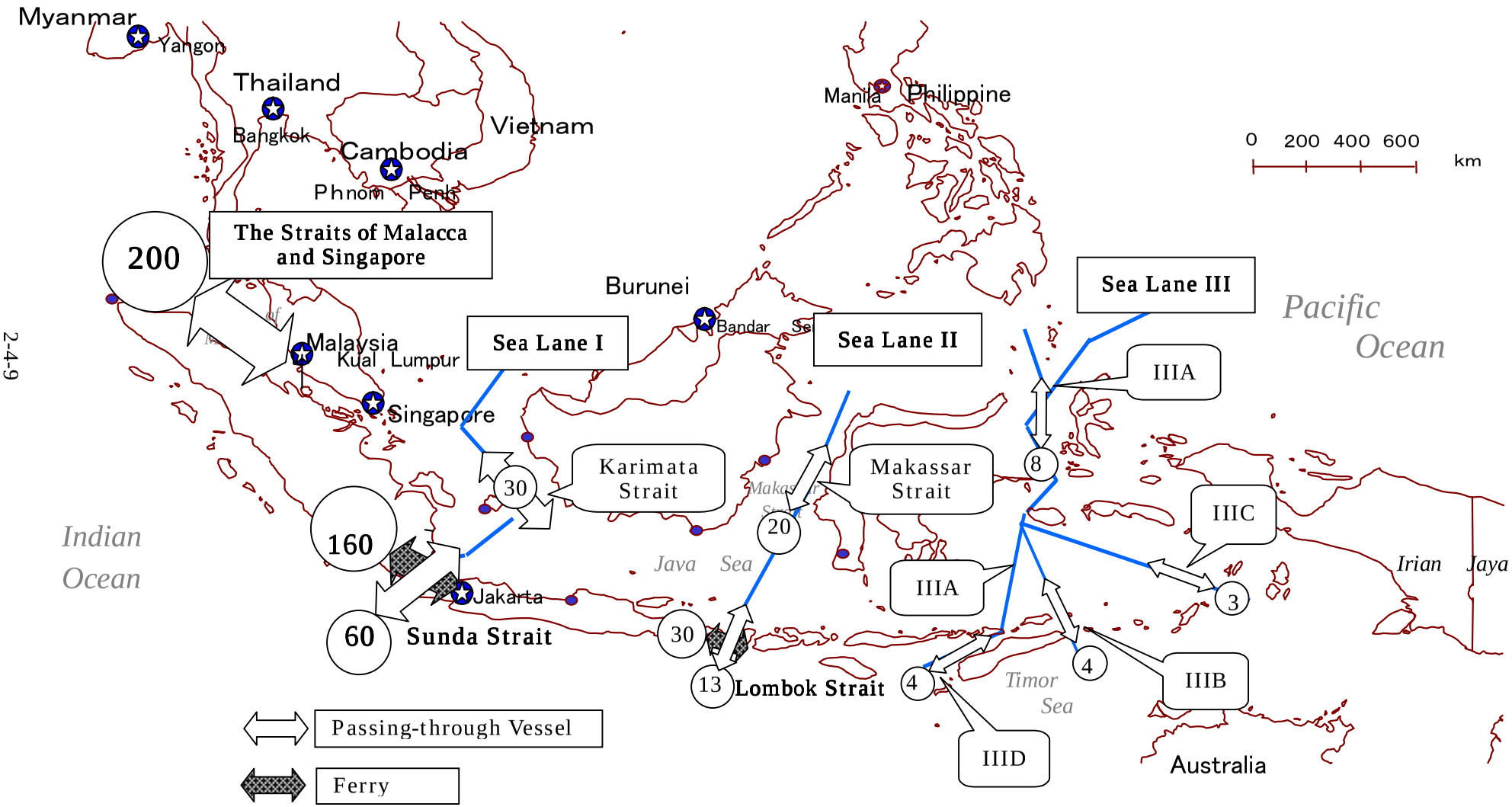
The daily marine through-traffic density in year 2001 is summarized in **Table 2.4.6**. and **Figure 2.4.2.**

Table 2.4.6. Daily Through-Traffic Density in Each Sea Lane

Name of Sea Lane	Strait	Estimated Daily Through-Traffic	
The Straits of Malacca and Singapore	At One Fathom Bank	200	
Sea Lane I	Sunda Strait	60	
	Karimata Strait	30	**90**
Sea Lane II	Lombok Strait	13	
	Makassar Strait	20	**33**
Sea Lane III	IIIA(between Mayu Island and Halmahera)	8	
	IIIC	3	
	IIIB	4	
	IIID	4	**19**

Source: JICA Study Team

Figure 2.4.2. Daily Marine Traffic Density for the Straits of Malacca and Singapore, Sea Lane I / II / III in 2001



(6) Estimated Number of Foreign Vessels passing-through Sea Lanes

The number of foreign vessels was estimated based on the result of the marine traffic density surveys as shown in **Table 2.4.7.**

Table 2.4.7. Estimated Number (percentage) of Foreign Vessels Passing-through Sea Lanes

Sea Lane	Strait	Date Surveyed	Number of Passing-Through Vessels during 2days	Estimated Number of Foreign Vessels (percentage)
Sea Lane I	Sunda Strait 1st Survey	14:00hrs May 15th to 14:00hrs May 17th 2001	108	25 (23%)
	Sunda Strait 2nd Survey	15:00hrs Oct. 18th to 13:00hrs Oct. 20th 2001	103	31 (30%)
Sea Lane II	Lombok Strait	14:00hrs May 18th to 14;00hrs May 20th 2001	16	14 (88%)
Sea Lane III	Maluku Sea between Mayu Island and Halmahera	12:00hrs Oct.15th to 12:00hrs Oct.17th 2001	13	13 (100%)

Source: JICA Study Team

It was concluded from the marine traffic density surveys that the ratio of domestic vessel to foreign vessel for the through-traffic in each sea lanes was estimated **3 to 1 (about 25%) in Sunda Strait** of Sea Lane I, **1 to 9 (about 90%) in Lombok Strait** of Sea Lane II and **0 to 10 (nearly 100%) in Maluku Sea between Mayu Island and Halmahera** of Sea Lane III.

2.4.8. Traffic Control Operation in the Straits of Malacca and Singapore

Traffic control operations are enforced only in the Straits of Malacca and Singapore by the Governments of Singapore and Malaysia.

- Mandatory Ship's Routeing System
- Mandatory Ship Reporting System
- Vessel Traffic Services (VTS)

2.5. Maritime Shipping and Traffic

2.5.1. Shipping

Shipping in Indonesia is divided into the following four forms. In a case where a vessel turns around plural domestic ports, and finally arrives in a foreign country in the neighborhood like Singapore, it is not treated as Ocean Going Shipping but classified as Inter-island Shipping in statistics in Indonesia.

(1) Ocean Going Shipping

This Shipping may be thought to be about the same as the general idea of Ocean Going Shipping.

In Indonesia, the cargo handling for Ocean Going Shipping is limited to six member companies of "Indonesia National Lines (INL)".

Because of overwhelming shortage of Indonesian vessels, 96% of cargoes for Ocean Going Shipping is being transported actually by foreign vessels, and the ratio is still increasing.

(2) Inter-island Shipping

Inter-island Shipping may be thought to be about the same as the general idea of Coastal Shipping, but the shipping in the same island such as that from Jakarta to Surabaya is also included in Inter-island Shipping.

Inter-island Shipping includes the following two shipping forms.

a. Traditional Shipping

Inter-island Shipping by small vessels less than 35GT

b. Local Shipping

Inter-island Shipping by medium vessels over 35GT but less than 175GT

(3) Pioneer Shipping

The purpose of Pioneer Shipping is to make sure the transportation of passengers and daily necessities to support developing islands isolated in the remote place. This shipping has been given financial assistance by Indonesian government. This shipping is done by only PELNI; which is the national company under permission.

(4) Special Shipping

Special Shipping is marine transportation to do chiefly for oneself by using own vessels. An enterprise and so on operate the vessels. PERTAMINA is a typical example of using this type of shipping. It is a national oil enterprise and transports its petroleum by its own oil tankers.

2.5.2. Maritime Traffic Network

Coastal shipping in Indonesia is composed of Inter-island Shipping and Pioneer Shipping. Coastal shipping in Indonesia is a combination of these types of shipping, and transports domestic cargoes to each region in Indonesia.

2.6. Fishery

2.6.1. General Data of Fishery

Indonesia is endowed with vast fishery resources both the coastal waters and the further offshore waters including the Indonesian Exclusive Economic Zone. (IEEZ). The size of fishery waters in Indonesia is shown in **Table 2.6.1**.

Table 2.6.1. Size of Fishery Waters in Indonesia

Item	Figure of the Size
Land Area:	1.91 million square km
Territorial Waters:	3.17 million square km
Shelf Area (to 200m depth)	2.713 million square km
IEEZ area including Territorial Waters:	5.883 million square km
Length of Coastline:	81,000 km

2.6.2. Organization of Fishery Industry in GOI

Up to year 1999, fishery industry had been managed by the Directorate General of Fisheries of the Ministry of Agriculture.

The Ministry of Sea Exploration was established based on Presidential Decree No.355/M of 1999. This ministry shortly became the Ministry of Sea Exploration and Fisheries according to Presidential Decree Number 147 of 1999. After the cabinet change followed the Annual Session of the People's Consultative Assembly in 2000, the Ministry of Sea Exploration and Fisheries became the Ministry of Marine Affairs and Fisheries under Presidential Decree Number 165 of 2000 and it is existing as of March 2002.

2.6.3. Fishery Production

(1) Number of Fishermen

The total number of fishermen was about 4.5 million in year 1998. About a half of the number was the fishermen engaged in marine fishery and the rest for inland fisheries including fish culture. The transition of sub-sector-wise number of fisherman is shown in **Table 2.6.2.**

Table 2.6.2. Transition of Sub-sector-wise Number of Fishermen

Sub-sector	1990	1994	1995	1996	1997	1998
Fishermen	1,994,414	2,315,787	2,463,237	2,538,954	2,596,428	2,729,341
- Marine Fishermen	1,523,472	1,850,244	1,957,678	2,055,034	2,087,802	2,274,629
- Open-water Fishermen	4709,942	465,543	505,559	483,920	508,626	454,712
Fish Farmer	1,622,296	2,064,119	2,104,822	2,129,528	2,052,725	1,805,470
- Brackish-water Pond Culture	150,627	205,462	212,196	223,360	223,878	243,630
- Freshwater Pond Culture	1,119,050	1,388,779	1,388,710	1,396,299	1,343,607	1,251,071
- Cage Culture	11,111	29,731	44,804	39,425	49,975	53,436
- Paddy Field Culture	341,508	440,147	459,112	470,444	435,265	257,333
Total	3,616,710	4,379,906	4,568,059	4,668,482	4,649,153	4,534,811

Source: Fishery Statistics of Indonesia 1998 (2000 Edition) Unit: person

(2) Marine Fisheries

Indonesian marine fisheries are very complex and diverse, reflecting the country's geographic characteristics and great variations in species and population densities.

The western part of Indonesian archipelago includes the relatively shallow Sunda Shelf area, which is bounded on the east roughly by Makassar and Bali Straits, and includes the large islands of Sumatra, Java and Kalimantan. These waters, which are relatively rich, produce about two-thirds of the total fish catch and attract large amounts of fishing efforts, particularly in the areas relatively close to shore.

Except for the shelf area between Irian Jaya and Australia, i.e., Arafura Sea of the Sahul Shelf, deep waters mark the eastern part of the archipelago. In the Arafra Sea, there is commercial fishing for shrimps, while outside this area, there are large-scale operations focused on tuna and skipjack fisheries.

Total production of marine fisheries was 1,081.6 thousand tons in 1976 and 4,076.0 thousand tons in 1999.

Total fishing boats of marine fisheries numbered 459,894 in 1999 and more than 50 percent of the fleet were non-powered boats (53.8percent). Among the powered boats, 55.76 percent of them used outboard engines and were typically small-sized boats of less than 5 GRT. Most of the non-powered boats were dugout canoes, ranging from 3 to 10 meters in length and generally operated by three to five fishers, using a wide variety of gear, including fill-nets, cast nets, traps, seines and hook-and-line. Their fishing grounds are in the waters close to their home base in a daily trip.

Fishing households involved in the marine capture fisheries numbered 453,104 in 1998 and 483,792 in 1999 (6.8 percent up compared to 1998). A big part of the fishing households was in Sulawesi (24.29 percent), followed by Sumatra (23.98 percent), Jawa (18.35 percent), and Bali & Nusa Tenggara (12.23 percent) in 1999.

(3) Inland Fisheries and Aquaculture

Almost all of the products from open water capture fishery (321,962 tons) in 1999 was fin-fish of various species (over 90 percent). Most came from Kalimantan (44.6 percent), Sumatra (27.9 percent), Java (15.6 percent) and Sulawesi (9.6 percent). The biggest product of region-wise aquaculture is

Jawa (52.7 percent), followed by Sulawesi (23.1 percent), Sumatra (18.3 percent), and Kalimantan (4.0 percent).

Inland and culture fisheries produced 401.3 thousand tons in 1976 and 1,041.4 thousand tons in 2000, 744.1 thousand tons from aquaculture and 297.3 tons from capture. Blackish water cultivation produced 360.8 thousand tons, freshwater pond produced 185.2 thousand tons, paddy field culture produced 100.8 thousand tons, and cage culture produced 97.3 thousand tons.

A total of 120,592 fishing boats were employed for open water fisheries in 1999. Most of them were non-powered (90.0 percent), while the rest were powered boats, mostly with outboard engine (94.4 percent).

(4) Utilization of Fish Production

58.4 percent of fish production is consumed as fresh fish. There are, however, severe limits to the supply of ice and refrigerated storage and transport facilities, so most of the balance of the catch is processed and consumed as dried and salted (22.7 percent) and smoked, boiled or fermented. There are about 8,000 small fish processing operations, generally using traditional methods. **Table 2.6.3**. shows the amount of utilized fish production excluding culture fish in 1998.

Table 2.6.3. Utilization of Fish Production Excluding Culture Fish (1998)

Detail	Sea	%	Inlandwater	%	**Total**	**%**
Fresh Fish	2,091,261	56.2	252,825	87.6	**2,344,086**	**58.4**
Canned	331,139	8.9	5,514	0.5	**332,653**	**8.3**
Frozen	53,434	1.4	20	0.0	**53,454**	**1.3**
Salted/dried	882,677	23.7	29,663	10.3	**912,340**	**22.7**
Boiled	151,799	4.1	461	0.2	**152,260**	**3.8**
Fermented	63,715	1.7	214	0.1	**63,929**	**1.6**
Smoked	66,982	1.8	2,947	1.0	**69,929**	**1.7**
Fish meal	44,094	1.2	23	0.0	**44,117**	**1.1**
Other	38,645	1.0	999	0.3	**39,644**	**1.0**
Total	**3,723,746**	**100**	**288,666**	**100**	**4,012,412**	**100**

Source: Fishery Statistics of Indonesia 1998 (2000 Edition) Unit: tons

2.6.4. State of Fishery Industry

The fisheries of western part of the country in general differ from those of the eastern part. In the west, the fisheries take place in the relatively shallow and fertile waters of the Sunda Shelf, in a region where large populations create a high demand and there are many fishermen.

The shrimp stocks provide one of the most valuable resources in this area.

Trawling for shrimp began in the late 1960s, and increased rapidly in the following years. However, the trawlers operated in inshore waters where they damaged the gear of the small-scale fishermen and took large amounts of other fish, which were of value to small-scale fishermen. Conflict between the trawlers and small-scale fishermen led to a total ban on trawling except in parts of the eastern area of the country, where trawling is permitted provided the nets are equipped with by-catch excluder devices.

Thus, except for growing amount of purse seine fisheries for small archipelagoes in the Java Sea and Malacca Strait and a small amount of tuna fishing in the Indian Ocean, the western part of the country is dominated by small-scale fisheries.

To overcome the problems of resources depletion and overcrowding in fisher communities, development of marine fisheries is directed to potential waters in the eastern part of the country and the EEZ, shifting jobs to marine culture, brackish-water culture or fish processing and enhancing of artificial reef development. Other efforts are through promotion of fisher transmigration.

2.7. Marine Casualties

2.7.1. Marine Casualty Statistics

Marine Casualty Statistics from April 1982 to December 2000 are shown in **Table 2.7.1.** According to the statistics, 3,826 cases of marine casualties occured during 18 years and 8 months. The average number of casualties per year is 204.1. The most frequent type of casualties is "Sunken" and the yearly average is 87.1. It accounts for 42.7 % of total casualties.

Number of human loss is listed from April 1992 to year 2000. A total of 3,038 of human lives were lost during 8 years and 8 months and the average per year is 347.

Vessels are divided into three groups by gross tonnage; vessels less than 35GT, from 35GT to 75GT, and over 75GT. Their percentages to total vessels are respectively 30.8%, 33.8% and 35.4%.

2.7.2. Daily Marine Casualty Data

(1) Verification of DGSC's Marine Casualty Data

The Study Team verified DGSC's marine casualty data by utilizing the newspaper's scrap data from the year 1994 to 2000.

The result of the verification is summarized in **Table 2.7.2.** This table shows that the average number of the unlisted accidents is 16.4 per year and dead / missing persons is 179.1 per year during 7 years from 1994 to 2000.

(2) Marine Casualty Data supplemented by Maritime Court Decision Data

As most of the marine casualty data provided by DGSC have no position data, the Study Team supplemented the blank position with Maritime Court Decision data if available..

2.7.3. Cause of Marine Casualties

The causes of the marine casualties have never been properly categorized in DGSC's report as shown in item No.6 "Causes" of **Table 2.7.1**. However, it is easy to estimate through newspapers or maritime court decisions that major passenger boat disasters were resulting from a lack of ship's stability due to overloading or old age in the rough sea. Recent major casualties mainly caused by less ship's stability are summarized in **Table 2.7.3.**

Table 2.7.1. Marine Casualty Statistic from April 1982 to December 2000

No.	Casualties	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997	1998	1999	2000	Total	Per Year
1.	**Type of Casualty**																(Apr-Dec)					
	Sunken	171	121	138	158	107	107	120	101	79	82	75	65	62	54	40	43	42	41	27	1,633	87.1
	Fire	15	5	12	4	9	7	7	2	15	6	12	3	13	21	16	5	11	17	8	188	10.0
	Collision	37	26	30	14	19	24	12	24	23	17	23	14	30	21	18	15	16	9	3	375	20.0
	Engine Trouble	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	5	1	1	8	2.1
	Aground	47	37	34	30	23	26	30	24	29	30	25	24	26	13	12	12	13	19	9	463	24.7
	To Float	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	2	0.5
	Leakage	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	5	3	3	12	3.2
	Other	98	117	109	141	115	68	94	86	76	63	47	27	24	22	22	5	10	9	12	1,145	61.1
	Total	**368**	**306**	**323**	**347**	**273**	**232**	**263**	**237**	**222**	**198**	**182**	**133**	**155**	**131**	**108**	**82**	**103**	**99**	**64**	**3,826**	**204.1**
2.	**Looses**																(Apr-Dec)					
	Human Looses	-	-	-	-	-	-	-	-	-	-	147	139	206	611	120	166	151	841	657	3,038	347
	Cargo Looses	-	-	-	-	-	-	-	-	-	-	17300	17100	14800	43000	9800	18809	2688	4027	17024	144,548	16520
	Car Looses	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15	3	-	18	5
	Animal Looses	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	36	204	560	800	200
3.	**Flag**																(Jan-Dec)					
	Indonesia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	83	99	98	55	335	84
	Foreign	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19	5	10	17	51	13
	Total	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**102**	**104**	**108**	**72**	**386**	**97**
4.	**Gross Tonnage**																(Apr-Dec)					
	< 100M3 (<35 GT.)	99	77	94	137	93	85	112	92	90	85	80	60	55	44	30	18	27	13	10	1,301	69.4
	100M3 - 500M3	180	155	158	129	112	99	86	88	82	60	64	40	43	60	37	10	6	15	4	1,428	76.2
	(35GT — 75GT)																					
	> 500m3 (> 75 GT.)	95	99	83	91	77	72	90	82	89	86	78	52	85	58	74	74	71	80	58	1,494	79.7
	Total	**374**	**331**	**335**	**357**	**282**	**256**	**288**	**262**	**261**	**231**	**222**	**152**	**183**	**162**	**141**	**102**	**104**	**108**	**72**	**4,223**	**225.2**
5.	**Type of Vessel**																(Apr-Dec)					
	Motor Ship	230	208	191	211	195	193	201	177	187	160	171	120	125	126	109	70	81	78	62	2,895	154.4
	Motorized Sail Boat	106	108	111	106	59	50	53	51	34	40	34	22	40	27	11	12	13	23	4	904	48.2
	Sail Boat	30	11	28	30	17	6	17	15	18	16	4	3	8	0	6	11	5	2	1	228	12.2
	Barge	8	4	5	10	11	7	17	19	22	15	13	7	10	9	14	11	5	5	5	197	10.5
6.	**Causes**																(Apr-Dec)					
	Human Error	163	100	123	114	55	75	84	81	91	86	92	63	71	51	53	33	44	40	25	1,444	77.0
	Force Major	116	106	110	146	111	112	117	125	91	68	44	38	49	46	39	44	25	38	25	1,450	77.3
	Hull Structure	89	100	90	87	107	45	62	31	40	44	46	32	35	34	16	5	34	21	14	932	49.7
	Total	**368**	**306**	**323**	**347**	**273**	**232**	**263**	**237**	**222**	**198**	**182**	**133**	**155**	**131**	**108**	**82**	**103**	**99**	**64**	**3,826**	

Source: Section of Ship Accidents, DGSC

Table 2.7.2. Number of Unlisted Marine Casualty Data in DGSC's Report

Unlisted in the DGSC's Marine Casualty Data	1994	1995	1996	1997	1998	1999	2000	Total	Average per Year
No. of Accident	15	11	22	18	16	16	17	115	**16.4**
No. of Dead	30	21	70	81	79	81	14	376	**53.7**
No. of Missing	70	95	389	45	93	114	72	878	**125.4**
Total of Dead / Missing	**100**	**116**	**459**	**126**	**172**	**195**	**86**	**1254**	**179.1**

Source: JICA Study Team

Table 2.7.3. Recent Major Casualties Caused by Less Stability

Casualty Occurrence		Ship's Type	Cause of Casualty	Fatality Toll including Missing
Year/Month	Location			
Jan.19, 1996	Off Aceh	Ferry	Capsized	338
Jul. 12,1997	Off Batam Island	Passenger Ship	Capsized	14
Jul. 14,1997	Lake Toba	Passenger Ship	Capsized	83
Jul. 20,1997	Off Southern Sulawesi	Passenger Ship	Capsized	9
Jun.25,1998	Lombok Strait	Ferry	Sunken	78
Aug.17,1998	Off Cituis Fishery Port	Passenger Ship	Capsized	16
Nov.13,1998	Off Lambasina	Ferry	Capsized	21
Nov.15,1998	Makassar Strait	Craft Carrier	Capsized	Nil
Feb. 6, 1999	Off Tembelan Island	Wooden Sailboat	Sunken	313

Source: DGSC, Maritime Court Decision

2.7.4. Outline of Major Casualties in 2000

(1) Sunken Ferryboat over-carrying Passengers

The ferry Masnait which was carrying at least 130 passengers over the capacity of 62 passengers and 12 crew, sank off Ambon Island on May 7th 2000 en route from Hunimua in Ambon Island to Waipirit in Seram Island due to rough sea.

The sunken ferry was not seaworthy because it was designed to operate on lakes and rivers, and furthermore she was overloaded with passengers and cargoes. This casualty resulted in death of 41 passengers and 4 crew members.

(2) Sunken Ferryboat carrying refugees fleeing sectarian violence in Tobelo

A ferryboat named Cahaya Bahari carrying 476 refugees and 16 crews sank about 60 kilometers east of Siau Island in North Sulawesi on June 29th 2000 en route from Halmahera Island in North Maluku to Manado in North Sulawesi due to rough sea.

This disaster was caused by over-boarding of passengers exceeding the capacity of 270. The ferryboat lost her balance and capsized in the rough sea. 10 survivors were rescued but others were dead or still missing.

2.7.5. Marine Casualty Statistics in the Straits of Malacca and Singapore

(1) Number of Marine Casualties

During 25 years from 1977 to 2001 the number of marine casualties was 216. The average number per year was 8.64 and the top type of marine casualties was "Collision" numbering 114(52.8%), followed by "Grounding" with 66(30.6%) and "Sinking" with 19(8.8%) as shown in **Table 2.7.4.**

Table 2.7.4. Number of Marine Casualties by Type (1977～2001)

Item	Collision	Grounding	Sinking	Fire	Explosion	Flooding	Total
Number	114	66	19	11	4	2	216
Percentage	52.8	30.6	8.8	5.1	1.9	0.9	100

Source: Casualty File by Lloyd's Maritime Information Services Limited (LMIS), JAMS

(2) Number of Vessel involved in Marine Casualty

During 25 years from 1977 to 2001 the number of the vessels involved in marine casualties was 319.

The average number per year was 12.76 and the top type of the vessels involved was "**Tanker**" numbering 96(30.1%), followed by "General Cargo" with 42(13.2%) and "Dry Bulk" with 21(6.6%) as shown in **Table 2.7.5**

Table 2.7.5. Number of Vessels Involved in Marine Casualties by Ship's Type (1977～2001)

Item	Tanker	General Cargo	Dry Bulk	Chemical	Container	LNG / LOG	Fishing Boat	Ro / Ro	Passenger	Others	Unknown	Total
Number	96	42	21	17	15	10	6	6	5	9	92	319
Percentage	30.1	13.2	6.6	5.3	4.7	3.1	1.9	1.9	1.6	2.8	28.8	100.0

Source: Casualty File by Lloyd's Maritime Information Services Limited (LMIS), JAMS

The top range of ship's gross tonnage was "～50,000" numbering 84(26.3%), followed by "～5,000" with 41(12.9%) and "～150,000" with 33(10.3%) as shown in **Table 2.7.6.**

Table 2.7.6. Number of Vessels Involved in Marine Casualties by Ship's Gross Tonnage (1977～2001)

Item	～1,000	～ 5,000	～ 10,000	～ 50,000	～ 100,000	～ 150,000	150,000 ～	Un known	Total
Number	28	41	29	84	28	33	1	75	319
Percentage	8.8%	12.9%	9.0%	26.3%	8.8%	10.3%	0.3%	23.5%	100%

Source: Casualty File by Lloyd's Maritime Information Services Limited (LMIS), JAMS

2.8. Piracy and Armed Robbery

2.8.1.Occurrence of Incident

According to the International Maritime Bureau（IMB）,

(1) Worldwide reported piracy incidents in 2000 reached 469, recording the highest in the port. It showed an increase of 56% compared with 1999 figures and nearly four and half times more compared with 1991.

(2) Indonesia recorded the highest number of attacks in the world and accounts for almost one quarter of the world's piratical attacks. During the decade from 1991 to 2000, pirate incidents which appeared in the Indonesian sea area is changing. There were 60 cases until 1998, but the cases were rapidly in creasing two years. There are 115 cases in 1999 and 119 cases in2000.

(3) Malacca Strait, one of the world's busiest shipping lane, which for many years had a relatively safe record, experienced 75 incidents in 2000 comparing with only two in 1999. It is now considered the second most dangerous piracy prone area following Indonesia

2.8.2.Enforcement of Measures

(1) Worldwide measure

Maritime Safety Committee (MSC) of International Maritime Organization (IMO) has considered the problem of piracy and armed robbery against ships in the committee since more than 10 years ago, and it published the various circulars. Moreover IMO draw up "Code of practice for the investigation of the crimes of piracy and armed robbery against ships", and this Code was resolved at the General assembly in November 2001.

For the prevention of piracy and armed robbery against ship, the United Nations asks ratification of "Convention for the suppression of Unlawful acts Against the Safety of Maritime Navigation" (SUA Convention) and preparation of proper law system for the prosecution of piracy and armed robbery to all the countries in the Assembly held in May 2001. The UN recommended to the coastal countries, where piracies and armed robberies have been rampant, to plan urgent and proper counter measures against them.

(2) Measure in Indonesia

Concerning security on the sea, the navy coordinates the relating authorities,

and responds to incidents. Also concerning the regulation of piracy and armed robbery against ships, the navy coordinates “the Coordinating Body for Security at sea” which consists of navy, marine and aviation police, GAMAT and customs, and takes necessary measures.
National SAR Agency (BASARNAS) of MOC takes a charge of contact point based on the IMO recommendation concerning information of piracies.
BASARNAS is the organization as the overall rescue coordination center in Indonesia for carrying out rescue on land, at sea, and in the air.
GAMAT takes a charge of international contact point in Indonesia concerning the problem of piracy.

To control piracies in Indonesian sea area, the navy, marine and aviation police and GAMAT have their own regulations, and in addition they also carry out joint enforcement activities as “the Coordinating Body for Security at sea”.
The ships of the navy, marine police, GAMAT and customs hold joint training against piracy with Malaysian naval ships and Singapore naval ships several times a year.
The Navy installed the Pirate Prevention Order Control center in island of Batam for the prevention of pirate incident in Malacca and Singapore Straits and Philip Channels.

2.9. Sea-borne Cargoes and Passengers

2.9.1. Sea-borne Cargoes

Total volume of sea-borne cargoes handled at all of public ports in Indonesia reached 519 million tons in 1999, which included the cargo volume handled at non-commercial ports.

(1) Foreign Trade Cargoes

A total of 112,363,938 tons of foreign trade cargoes was handled in 1983 and 338,768,974 tons in 1999. The domestic vessels carried 20,081,234 tons (17.90 percent) of foreign trade cargoes in 1983 and 16,236,366 tons (4.79 percent) in 1999.

(2) Domestic Trade Cargoes

A total of 58,865,372 tons of domestic trade cargoes was handled in 1983 and 180,229,152 tons in 1999. The domestic vessels carried 38,417,079 tons (65.30 percent) of domestic trade cargoes in 1983 and 90,985,556 tons (50.48 percent) in 1999.

(3) Containerized Cargoes

Container traffic has continued to expand rapidly in Indonesia although only a few ports have specialized berths, equipment storage yards and related facilities.

Total TEUs (twenty foot equivalent of unit) amounted to over 2.85 million in 1996 and increased to about 3.1 million in 1998. Based on approximately 10 tons per TEU, this implies about 29 million tons of containerized cargo in 1996 and 31 million tons in 1998.

2.9.2. Sea-borne Passengers

Sea transport services (PT. PELNI) operate regular but often infrequent services with relatively large ships on multi-stage routes using ports / terminals owned and managed by others, and carry passengers and some cargoes.

(1) Domestic Passenger

Passenger demand on domestic shipping services has been growing rapidly since the early 1990's. Some of this demand has been accepted by such capacity-up as the steady expansion of PT PELNI's passenger shipping fleet with large modern vessels (built in Germany) being supplied. Demand also rose with the continued expansion of inter-island movement and the work opportunities in Malaysia being partly fed by domestic shipping to the islands of Batam, Tanjung Balai and Bintang.

DGSC data shows that Indonesian ports handled some 10.2 million domestic passengers in 1996 (5.1 million trips). By 1998, total domestic passengers increased to 14.6 million movements.

(2) International Passenger

International sea passengers are largely short distance travelers from Sumatra (including Batam / Bintan / Tanjung Balai) to Singapore or Malaysia. Travelers are usually Indonesian workers or Singaporean weekend tourists going to Batam / Bintan. Other international routes are to Sabah / Sarawak or the Philippines. Cruise passengers make up only a small proportion of international sea passengers.

In 1996, there were nearly 3.8 million international passengers (arrives and departures) and in 1998 this number had grown to 4.8 million passengers.

2.9.3. Ferry Boat Passengers and Cargoes

Ferry transport services (PT. ASDP) operate regular and frequent services with relatively small ships on routes between two defined locations normally owned / managed by PT. ASDP, and carry passengers, vehicles and related cargoes.

As of April 2000, there are some 24 private ferry companies, which are operating 46 ferry boats on commercial routes and, among these, three (3) routes are exclusively used by private companies.

Coordination could be improved between DGLC responsible for inland waterways and ferries, and DGSC responsible for sea transportation and the safety aspects of all waterway / sea transportation.

Statistic figures of ferry boat passengers and cargoes since 1987 to 1995 are shown in **Table 2.9.1.**

Table 2.9.1. Passengers and Cargoes of Ferry Boat (1987-1995)

	1987	1988	1989	1990	1991
Passenger	**21,570,727**	**25,617,924**	**28,664,859**	**31,626,598**	**32,194,981**
4- Vehicle	1,972,717	2,158,712	2,380,063	3,642,100	3,038,419
2- Vehicle	1,824,749	1,808,291	1,466,431	1,942,413	2,017,616
Cargo	3,664,455	5,173,709	4,503,699	6,330,354	7,280,586

	1992	1993	1994	1995
Passenger	**37,264,399**	**39,004,338**	**44,940,901**	**45,513,415**
4- Vehicle	3,248,537	3,612,256	4,745,212	4,652,769
2- Vehicle	2,216,816	2,123,077	1,626,441	3,719,501
Cargo	7,513,139	9,407,521	8,921,167	10,803,478

Source: DATA ANGKUTAN PENYEBERANGAN TAHUN 1987-1995: DGLC

2.10. Information Technology

(1) Current Situation

Information Technology (IT) in Indonesia has been remarkably developed for the last decade. **Table 2.10.1.** shows overview of the current IT services.

Table 2.10.1. Overview of IT Services

k : 1,000

		1992	1998
Telephone	Main telephone	1,650 k	5,571 k
	ditto density	0.8/100 inhab	2.7/100 inhab
	Mobile (Hp)	36 k	1,066 k
	Total		6,637 k
TV set density		n.a	13.6 /100 inhab
Radio set density		n.a	15.5 /100 inhab
Internet	Provider	0	10
	User	0	300 k
Personal computer		n.a	2,500 k

As of June 2001, number of main telephone subscribers of PT. Telkom has reached to 6.324 million, and mobile phone subscribers, belonging to PT. Telkomsel, PT. Satelindo, PT. Excelcomindo and other four (4) service providers, are 2.735 million. Newly started Satellite phone provider PT. Pasifik Satelit Nusantara is expecting some 35 thousand subscribers in the first year.

Internet users as of the end of year 2000 are estimated 900 thousand approximately. And recently PT. Telkom starts a broadband (512 kbit/s) services using Asymmetric Digital Subscriber Line (ADSL).

Since Indonesian satellite telecommunication have serviced-in year 1976, today, eight (8) national satellites, having 192 transponders in total, are launched and being operated on geo-stationary orbit (GEO). New generation satellites, Telkom-1 (PT. Telkom) and Garuda-1(PT. Pasifik Satelit Nusantara), provide their services to Asian countries, Papua New Guinea and north Australia too. Major services available by these satellites are;

- Transponder leasing (full or part of a transponder),
- Very small aperture terminal (VSAT) services for the speed up to 2 Mbps,
- Direct broadcasting service (DBS) for television and radio,
- Multimedia and Video conferences, and
- Internet connection services among provider's servers and IP gateways.

(2) Telecommunication's Market and its Regulations

Indonesian Telecommunication Act 36/1999 defines the type of services and its competitive structures as **Table 2.10.2.**

Table 2.10.2. Indonesian Telecommunication Act 36/1999

Type of Services			Structures	Major Providers
Telephone	Local	Cable	Monopoly *1)	Telkom + KSO
		Radio	Monopoly *1)	Telkom + KSO, Ratelindo
	Long distance		Monopoly *1)	Telkom
	International		Monopoly *2)	Indosat
Data com.			Competition	Telkom, Lintasarta
Mobile (Hp)	NMT		Competition, but to be joined with Telkom	Mobisel
	AMPS			Komselindo, Telekomind, Metrosel
	GSM			Telkomsel, Satelindo, Excelkomindo
	OCS/PCN			Cellnet, Primasel, etc.
Pager			Competition	Skytelindo, Multipage, etc.
Satellite com.			Competition	Telkom, Satelindo, MCI, etc.
Internet			Competition	Indosatnet, Radnet, etc

Note: *1) up to August 2002 *2) up to August 2003

It is worthy of remark that, as noted above, recently the periods of monopoly for local, long distance and international services given to PT. Telkom or PT. Indosat have been changed to shorten from the previous schedule.

(3) Trend in Future

Indonesian IT sector is one of the most growing business. New technologies such as digital satellite, fiber optic cable, mobile phone, broad-band subscriber system and internet, and new opening policy of the telecommunication field make this field to be more active, and to enable to provide cheaper services to the public.

This IT and its public service can be applied to DGSC's maritime and terrestrial networks. Therefore a part of DGSC networks formerly built-up by all own equipment/facilities will be replaced by such public telecommunication systems.

2.11. Port and Harbors

2.11.1. Port System in Indonesia

Indonesian ports are classified, in accordance with Shipping Law No.21/1992, into two main types i.e. **"Public ports"** and **"Special ports"**. The former are public ports available for public (general users) cargoes and are further subdivided into commercial and non-commercial ports. There are now a total of 111 (excluded Dilli) commercial ports and they are managed and operated by the port corporations (PELINDOS). These 111 commercial public ports generally handle the vast majority of public cargoes and obviously have better capacity than that of the non-commercial ports.

The commercial public ports in Indonesia are classified into two categories, commercial ports managed by four state owned companies (IPC I～IV) and non-commercial ports directly managed by government local offices (KANPEL) or its working units.

Special ports (and sometimes Special berths) are either privately operated for private cargoes to support manufacturing, forestry, fishing, mining and tourism or are operated by specific state corporations for bulk cargoes such as oil or fertilizer.

Besides these ports, there are ferry terminals under Directorate General of Land Communications (DGLC) and state owned company (ASDP), and fishery ports under the Ministry of Marine Affairs and Fisheries, and Provincial Government.

2.11.2. Classification of Ports

(1) Main Ports under SISTRANAS (The National Transport Development Plan)

SITRANAS has been described in detail in the Demand Forecasting Working Paper and proposed a hierarchy for the 112 (including Dilli in East Timor) public ports with two main groups and five sub-groups.

The proposed seaport hierarchy based on functional policy given in SISTRANAS (1996) was as follows:

① Primary Trunk Port (1) : International Trunk / Deep Seaports projected to serve direct trade to foreign countries (International direct shipment). Such ports will be provided with a full container terminal.

② Secondary Trunk Port (8): Major Trunk ports projected to serve trade to other countries and also transshipment (International shipment and

transshipment). Such ports are to be provided with full container facilities;

③ Tertiary Trunk Port (23): Minor Trunk ports that are projected to serve national as well as international trade. These ports provide semi-container facilities;

④ National Feeder Ports (21): These ports provide facilities appropriate for national and intra-regional trade;

⑤ Local Feeder Ports (58): These ports provide appropriate facilities for serving intra-regional trade.

Note: Number of ports in brackets is 111 in total except Dilli by late 2000.

SISTRANAS classification of main ports is shown in **Table 2.11.1**.

Table 2.11.1. Trunk Ports under SISTRANAS

Number	Primary	Secondary	Tertiary
1	Batam	Belawan	Lhokseumawe
2		Panjang	Dumai
3		Bojonegara	Pekanbaru
4		Tanjung Priok	Tanjung Pinang
5		Tanjung Perak	Teluk Bayar
6		Tanjung Emas	Palembang
7		Ujung Pandang	Cirebon
8		Bitung	Cilacap
9			Benoa
10			Pontianak
11			Sampit
12			Balikpapan/Kariangau
13			Samarinda
14			Banjarmasin/Batulicin
15			Kendari
16			Anggrek/Kuandang
17			Tenau-Kupang
18			Ambon
19			Sorong
20			Biak
21			Jayapura
22			Kumai
23			Kula Enok
Number of Ports	1	8	23

Source: DGSC

(2) DGSC Strategic Ports

The DGSC uses a simpler definition of 25 strategic ports which are not ranked and are based on three criteria of 'volume of cargo handled', 'location of port' and 'regional function of port'.

Application of these criteria leads to the selection of 25 ports which handle 70% of all public general cargo and 98% of all containers.

The DGSC strategic ports are shown in **Table 2.11.2**.

Table 2.11.2. DGSC Strategic Ports

No.	Province	Port	No.	Province	Port
1	Aceh	Lhokseumawe	14	Bali	Benoa
2	N. Sumatra	Medan(Belawan)*	15	E. Nusa Teng	Kupang
3	W. Sumatra	Padang(Teluk Bayur)	16	W. Kalimantan	Pontianak*
4	Riau	Dumai	17	E. Kalimantan	Balikpapan
5	Riau	Pekanbaru	18	E. Kalimantan	Samarinda
6	Riau	Tanjung Pinang	19	S. Kalimantan	Banjarmasin*
7	Riau	Batam	20	N. Sulawesi	Bitung
8	S. Sumatra	Pelembang	21	S. Sulawesi	Makassar*
9	Lampung	Panjang*	22	Maluku	Ambon
10	DKI Jakarta	Tanjung Priok*	23	Irian Jaya	Sorong
11	Central Java	Tanjung Emas*	24	Irian Jaya	Biak
12	East Java	Tanjung Perak*	25	Irian Jaya	Jayapura
13	W. Java	Banten/Bojonegara			

Source: Port Development Operation, DGSC, 1996 Note*: Containaer facilities

2.11.3. Handling Cargoes and Passengers

(1) Quantity of Handling Cargoes and its Share

Cargo handling quantities by major port are shown in **Table 2.11.3**

Table 2.11.3. Exports and Imports by Main Port and its Share

EXPORTS BY MAIN PORT					INPORTS BY MAIN PORT				
Port	1998				Port	1998			
JAVA	Million Tonnes		% of Total	%of sub total		Million Tonnes		% of Total	%of sub total
Jakarta	15.2		31%		Jakarta	14.4		53%	
Surabaya	4.5		9%		Surabaya	2.9		11%	
Semarang	1.5		3%		Semarang	0.9		3%	
Cirebon	0.0		0%		Merak	0.6		2%	
Others	4.2		9%		Others	3.0		11%	
Sub Total		25.4		52%	Sub Total		21.8		80%
SUMATRA									
Belawan	2.4		5%		Belawan	0.4		1%	
Pekanbaru/Dumai	2.0		4%		Pekanbaru/Dumai	0.1		0%	
					Jambi	0.1		0%	
Palembang	0.1		0%		Palembang	0.0		0%	
Panjang	0.8		2%		Panjang	0.1		0%	
Tanjung Pinang	0.0		0%		Padang	0.1		0%	
Others	9.2		19%		Others	2.2		8%	
Sub Total		14.5		30%	Sub Total		3.0		11%
KALIMANTAN									
Pontianak	0.4		1%		Pontianak	0.1		0%	
Banjarmasin	0.6		1%		Banjarmasin	0.1		0%	
Balikpapan	0.4		1%		Balikpapan	0.5		2%	
Tarakan	0.1		0%		x	-			
Others	4.4		9%		Others	0.6		2%	
Sub Total		5.9		12%	Sub Total		1.2		4%
SULAWESI									
Makassar	0.4		1%		Makasar	0.2		1%	
Bitung	0.2		0%		Bitung	0.0		0%	
Others	0.3		1%		Others	0.2		1%	
Sub Total		0.9		2%	Sub Total		0.4		1%
BALI/NTT									
Benoa	0.0		0%		x	-			
Kupang	0.0		0%		x	-			
Others	0.2		1%		x	-			
Sub Total		0.3		1%	Sub Total				0%
MALUKU									
Ambon	0.2		0%		Ambon	0.0		0%	
Amamapare	1.2		3%		x	-			
Others	0.4		1%		Others	1.0		4%	
Sub Total		1.9		4%	Sub Total		1.0		4%
TOTAL EXPORTS	48.9		100%	100%	**TOTAL IMPORTS**	27.4		100%	100%

Source:BPS and Consultants

(2) Quantity of Passenger in Strategic Ports

① Domestic Passengers

Indonesian ports handled some 10.2 million domestic passengers in 1996 (5.1 million trips). The largest quantity of domestic passenger in 1998 is 1,404 thousand (9.6 percent) in Tanjung Pinang followed by 1,343 thousand (9.2 percent) in Tanjung Perak, 1,102 thousand (7.5 percent) in Makassar.

② International Passengers

The largest quantity of international passenger in 1998 is 3,486 thousand (72.53 percent) in Batam followed by 618 thousand (12.8 percent) in Tanjung Pinang, 247 thousand (5.1 percent) in Dumai .

(3) Ferryboat Cargoes and Passengers by Traffic Routes

Statistics of the top five ports of ferry route in 1998 are shown in **Table 2.11.4**. The ferryboats which serviced between Merak and Bakauheni, carried the largest passenger of 14,029,736, followed by 13,575,435 (between Ujung and Kamal) and 5,323,194 (between Banyuwangi and Gilimanuk).

Table 2.11.4. Top Five of Ferryboat Route in 1998

Ferry Route	Passengers	Vehicles	Freight	Trips
Merak – Bakauheni (West Java / Lampung)	14,029,736	1,887,663	5,291,295	34,148
Ujung – Kamal (East Java)	13,575,435	1,522,377	1,731,325	92,835
Banyuwangi – Gilimanuk (East Java / Bali)	5,323,194	1,096,954	2,447,961	71,214
Padangbai – Lembar (Bali / Nusa Tenggara Barat)	983,447	169,777	654,434	10,584
Balohan(Saban) – Malahayu (DI Aceh)	161,789	25,553	10,769	982

Source: DGLC

CHAPTER 3.
EXISTING PLANS AND STRATEGY RELATED TO MARITIME TRAFFIC SAFETY SYSTEM

3.1. General

During the past 20 years, several study reports related to the Study have been compiled by JICA or other relevant authorities and some of the plans in the reports have been put into implementation.

Especially both the survey reports of "Survey Report on Long Term Development Plan of Maritime Communication System" issued in March 1982 by JICA and "The Master Plan on the Development of Aids to Navigation System" issued in October 1985 by JICA had the master plans which covered until the year 2000 and basically the Study is placed in serial study of them.

Therefore, before formulating the master plans of the Study, it is necessary to grasp the contents of the past study reports and to reflect them in the Study.

Table 3.1.1. shows the list of past study reports related to the Study.

Table 3.1.1. Past Study Reports Relating to the Study

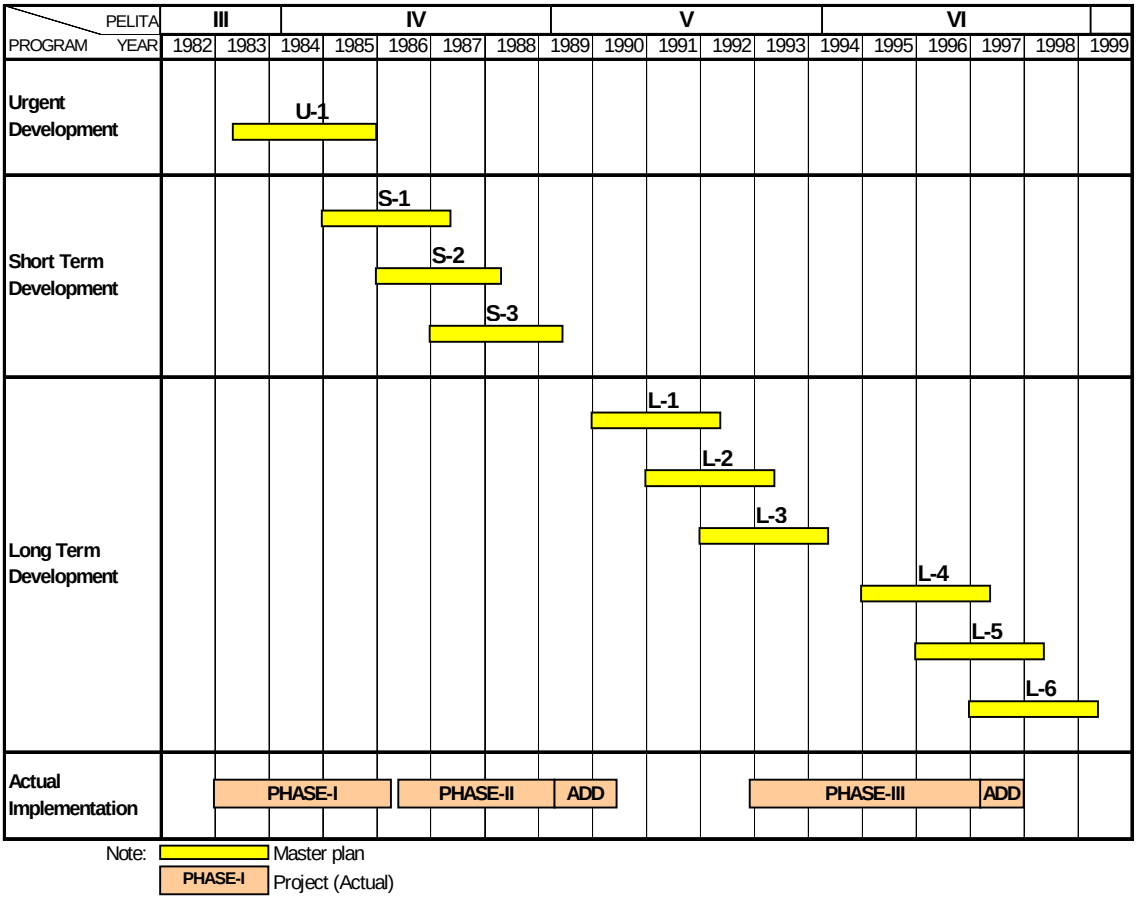
Title of Reports	Issued Date	Issued By	Contents
Survey Report on Long Term Development Plan of Maritime Communication System	Mar. 1982	JICA	Master plans for maritime communication system during the years from 1983 to 1999
The Master Plan on the Development of Aids to Navigation System in the Republic of Indonesia	Oct. 1985	JICA	Master plans for aids to navigation and its supporting facilities during the year from 1985 to 2000
The Study on Maritime Safety Plan concerning Search and Rescue	Feb. 1989	JICA	Long-term development plans up to year 2005 and short-term plans selected as urgent improvement projects from the long term plans concerning Search and Rescue
Feasibility Study in Vessel Traffic Management Services	Jun. 1998	French Consultant	Feasibility study report for VTMS establishments along Sea Lane I and Sea Lane II
Special Assistance for Project Sustainability (SAPS) for Maritime SAR Telecommunication System Project	Mar. 2000	JBIC	The study of the present status of the Marine Search & Rescue Telecommunications System Project and proposals for solutions of the problem
Basic Design Study Report on the Project for Rehabilitation for Medium Wave Radio Beacon Stations	Nov. 2000	JICA	The study to install DGPS stations instead of Medium Wave Radio Beacon
Navigation Safety Project by German Loan	Jun. 2001	German Consultant	German loan project placing visual aids to navigation along the Sea Lane I, II and III
Technical Co-operation in the Field of Maritime Safety Operation and Information Technology	Nov. 2001	JICA	Setting up maritime safety information network by computer system

3.2. "Survey Report on Long Term Development Plan of Maritime Communication System" Issued in March 1982 by JICA

In the master plan "Survey Report on Long Term Development Plan of Maritime Communication System" (F-TA-193) issued in March 1982 which covers until the year 2000, the whole period has been broadly divided into three (3) development programs called "Urgent", "Short Term" and "Long Term".

Along with the master plan, DGSC has rehabilitated and expanded coastal station's facilities by Maritime Telecommunication Phase-I, II and III projects under the JBIC loans from the year 1983 to 1997. **Table 3.2.2.** shows implementation schedules planned on master plan and of the projects.

Table 3.2.1. Implementation Schedules of Master Plan 1982 and Projects



Through these projects, most of the first-class and second-class coast stations as well as a part of the third or forth-class stations and some DGSC vessels for aids to navigation have been modernized.

Especially in the phase-III project, in response to the Amended SOLAS 88, RR WARC-Mobile 87 and coordination results of NAVAREA-XI, GMDSS equipment has been introduced in such stations, and NAVTEX transmitters were installed at Jakarta, Makassar, Ambon and Jayapura stations.

During these 20 years, the number of coastal radio stations has also increased. **Table 3.2.2.** shows the increment of stations and the number of GMDSS stations among them.

Table 3.2.2. Number of Coast Stations

Class	Number of stations			
	MP in 1982	As of End of Phase-III	Present (2001)	GMDSS
I	9	9	9	8
II	2	8	8	5
III	12	20	20	13
IV-A	14	96	103	4
IV-B	56	84	81	-
Total	93	217	221	30

Note Above classification at present is as follows:

Class	Type of Services	Operation Hours	Function at at the District
I	Maritime mobile, including public telecom service Fixed service	24h	Center
II	Maritime mobile, including public telecom service Fixed service	16-24h	Sub-Center
III	Maritime mobile, including public telecom service Fixed service	12-16h	
IV-a	Maritime mobile services Fixed service	8-12h	
IV-b	Fixed service only	8h	

3.3. "The Master Plan on the Development of Aids to Navigation System in the Republic of Indonesia" issued on October 1985 by JICA

3.3.1. Visual Aids to Navigation

(1)Status of visual aids to navigation

According to the Master Plan in 1985, there were 1092 lighted and 987 unlighted visual aids to navigation in Indonesia.

It gave the number of 3.3 units of lighted visual aids to navigation per 100 nautical miles along the coast lines in Indonesia, while in the developed countries there were 25 units per 100 nautical miles.

Numbers of visual aids to navigation as of March 1984 were summarized by type as follows:

① Lighted visual aids to navigation

• Lighthouse	149 units
• Light beacon	438 units
• Light buoy	342 units
• Harbor light	163 units
Total	1092 units

② Unlighted visual aids to navigation

• Small buoy	415 units
• Day mark	572 units
Total	987 units

(2) DGSC's non-property lights

There were a total of 227 lights as DGSC's non-property lights owned and being maintained mainly by PERTAMINA (State-Owned Oil Company) for their operations.

Numbers of non-property lights as of March 1984 were summarized by type as follows:

• Light beacon	86 units
• Light buoy	137 units
• Harbor light	4 units
Total	227 units

As regards the energy sources for visual aids to navigation, diesel generators and commercial electricity were mainly used. These two sources accounted for 87% of the energy for lighthouses. While acetylene gas accounted for 41% and 33% of light beacons and light buoys respectively.

3.3.2. Radio Aids to Navigation

As of 1985, radio aids to navigation in Indonesia were in the following conditions:

(1) Medium wave radio beacon (MFB) stations

The implementation of 1st phase project had already undergone for the establishment of eighteen stations. Eighteen (18) MFB stations are shown in **Table 3.3.1**.

Table 3.3.1. MFB Stations to be established in Indonesia

1	Sabang	7	Cilacap	13	Tg. Mandar
2	Simedang Island	8	Jamuang Island	14	Uj. Pandang
3	Tg. Priok	9	Tg. Selatan	15	Ambon
4	Pontianak	10	Benoa	16	Bitung
5	Pesemut Island	11	Balikpapan	17	Ram sorong
6	Mandalika Island	12	Tg. Mangkalihat	18	Merauke

(2) Radar beacon stations (Racon)

District of Navigation Offices of Dumai, Palembang and Surabaya operated three Racon stations established at existing lighthouses in 1984 respectively.

3.3.3. Supporting Facilities for Aids to Navigation

Supporting facilities comprises workshops and buoys bases. The workshop consists of a workshop and a storage house. The buoy base consists of a buoy base to maintain and repair buoys and open an storage to store mooring system of buoy.

Situation of these supporting facilities were as follows:

(1) Buoy base and open storage

There were five buoy bases at Dumai, Tg. Priok, Surabaya, Samarinda and Sorong, which covered the whole area of Indonesia.

(2) Workshop and storage

All Districts of Navigation had the workshop for carrying out relevant works, but further installations of necessary equipment were required for operation and maintenance of aids to navigation.

In addition to the supporting facilities above, aids to navigation vessels, jetty and gas plant had been maintained and operated.

There were 91 aids to navigation vessels consisted of 7buoy tender, 6 supply vessels, 50 aids tenders, 22 inspection boat, 1 survey vessels and other 6 vessels.

(3) Gas plant

A total of twenty nine (29)% of lighted aids to navigation were powered by acetylene gas. However, needs were not being sufficiently met, due to the limited supply capacity of gas at the plant.

3.3.4. Long Term Plan up to the Target Year of 2000

(1) Visual aids to navigation

The master plan required new establishment of 908 lighted aids to navigation up to years 2000. The total number was to reach 2000 units and to be improved 6.50 units per 100 nautical miles.

① Development of 908 lights consisted of:

- Lighthouses 201 units
- Light beacon (including harbor light and resilient light beacon) 357 units
- Light buoy 350 units

② Improvement of lights consisted of:

- Improvement of luminous range 61 units
- Monitoring of buoy 55 buoys
- Electrification 95 units
- Lighthouse automatization 3 lighthouses

(2) Radio aids to navigation

The number of radio aids to navigation to be developed up to years of 2000 was fifty seven (57) of medium wave radio beacon stations including eighteen (18) stations under implementation and seventy (70) radar beacon stations including the existing three (3) stations.

(3) Supporting facilities for aids to navigation services

The Improvement plan for supporting and logistic facilities is as follows:

① Workshop housing 17 locations
② Workshop equipment 21 locations
③ Open storage for buoy base 17 locations
④ Storage housing 19 locations

3.3.5. Aids to Navigation Developed and Improved by Loan

After the formulation of Master Plan in 1985, the aids to navigation in Indonesia have been mainly developed and improved by the foreign loan including Japan Official Development Assistance (ODA).

Total investment is 142million US Dollar for the development and improvement of aids to navigation field.

3.4. "The Study on Maritime Safety Plan Concerning Search and Rescue" Issued in February 1989 by JICA

3.4.1. Short Term Development Plan

The objective of the study was to formulate a short-term development plan selected as urgent improvement projects from the long-term development plans (up to year 2005) related to the Maritime Safety Plan concerning Search and Rescue.

(1) Search and Rescue System

① Construction of Maritime Safety Rescue Ships

Maritime safety rescue ships with long cruising range were required as shown in **Table 3.4.1.**

Table 3.4.1. Number of Ships by Class to be Newly Constructed and Planned Base

Ship's Class	Number of Ships	Planned Base
Class I-A	3	Tg. Priok, Surabaya, Ujung Pandang
Class I-B	2	Tg. Uban, Belawan
Class II	2	Tg. Priok, Surabaya

② Organizing Special Rescue Teams and, Research and Development for Rescue Technology

In order to surely and effectively rescue from marine accidents, four teams (one team consists of five members) should be organized in Jakarta and Surabaya bases. The teams were to be professionally trained at a specific training facility.

③ Prevention of Marine Disasters

To cope with marine disasters, the oil prevention equipment and materials should be provided on board the maritime safety rescue ships.

(2) Maritime Safety and SAR Communications and Information System

① Installation of EPIRB onboard

Considering a great number of accidents involving ships for domestic service, it was proposed to install EPIRB on 6,600 vessels that had not yet

installed them.

② Establishment Plan of MES (TTY Message Exchange System)

The MES for promptly and accurately transmitting SAR information to SAR-related organizations was planned to install on eight KANWILs except KANWIL III in Jakarta where the MES had already been planned by DGSC.

(3) Harbour Traffic Control System in Surabaya

It was proposed that introduction of traffic control system suitable for each port of Surabaya, Belawan and Tg. Priok was necessary. Surabaya Port, among the above three ports, had priority to establish because it was the prosperous and one of the busiest port in Indonesia.

(4) Training System for Maritime Safety and SAR Personnel

It was strongly suggested to urgently establish a Maritime Safety Training Center (MSTC) having the following functions in DGSC.

(5) Organization System

The organization for commanding and operating ships should be newly established in DGSC and Maritime District Offices (KANWILs). If the following organization was under the jurisdiction of DGSC and Head of KANWIL, prompt and efficient rescue from marine accidents could be attained.

① Operation center and its related organization
② Reinforcement of ship repair and maintenance personnel for maritime safety rescue ships
③ Maritime disaster prevention system and its organization
④ Special rescue system and its organization
⑤ Harbour traffic control system and its organization
⑥ Establishment of MSTC

3.4.2. Long Term Development Plan

The objective of the study was to establish a Master Plan for Maritime Safety concerning SAR including the review of the organizational set-up, and education and training institute and investment plan to up to year 2005.

(1) Maritime Safety and, Search and Rescue System

① Improvement of Maritime Safety Rescue Ships
② Moorage-piers for Exclusive Use of Maritime Safety Rescue Ships

It was necessary to construct new moorage-piers at Tanjung Priok, Surabaya and so on, where Class I-A and I-B maritime safety rescue ship were to be allocated.

③ Allocation of Aircraft

The optimum allocations of aircraft are shown in **Table 3.4.2**.

Table 3.4.2. Number and Allocation of Aircraft

Type	KANWIL	DGSC Air Station	Airport	No. of Aircraft
Airplane	III	Jakarta	Jakarta	2
	VI	Ujung Pandang	Ujung Pandang	2
	Sub Total			**4**
Helicopter	I	Medan	Medan	2
	II	Tg. Uban	Tg. Uban	2
	III	Jakarta	Jakarta	2
	IV	Surabaya	Surabaya	2
	VI	Ujung Pandang	Ujung Pandang	2
	VIII	Ambon	Ambon	2
	Sub Total			**12**
	Grand Total			**16**

④ Special Rescue Team

Special Rescue Teams were to be formed to carry out special tasks as given below.

a. To rescue vessels carrying dangerous cargoes such as high pressure gas, toxic substances;

b. To rescue crews of capsized or sunken vessels by utilizing skilled scuba diving techniques;

c. To send specially trained rescue teams by helicopter to scenes that maritime safety rescue ships can not approach.

⑤ Ship Reporting System

In Indonesia, the ship reporting system may be implemented through the joint use of the SAR information networks, Message Exchange System and Management Information System.

(2) Marine Disaster Prevention

① Allocation of On-shore Bases

In addition to the allocation of important bases for maritime safety rescue ships, on-shore bases for the disposition of marine disaster prevention units

should be allocated with consideration given to location of marine accidents.

Under the above conditions, on-shore bases for marine disaster prevention units should be located at the following nine ports;

Belawan, Tg. Uban, Tg. Priok, Palembang, Surabaya (Tg. Perak), Cilacap, Balikpapan, Ujung Pandang and Bitung.

② Marine Disaster Prevention Units

It was advisable to establish Marine Disaster Prevention Units at each base, under KPLP units, which was to be deployed for real time operations.

(3) Maritime Safety and, SAR Communications and Information System

① Establishment of Maritime SAR Telecommunications System

② Establishment of Maritime SAR Information Networks

③ Establishment of Command and Control Communications System including Ship-reporting System

(4) Harbour Traffic Control System

A Traffic Control Center was to be established at each port of Surabaya, Belawan and Jakarta (Tg. Priok).

(5) Education and Training System for Maritime Safety and SAR Personnel

Establishment of DGSC Academy was proposed to secure maritime safety personnel in order to keep high level of knowledge and experience in SAR activities, maritime traffic safety, environmental protection, radio communications and aids to navigation.

(6) Maritime Safety and SAR Organizational System

The suggestion and advice on the establishment of sub-organizations were made specifically referring to the maritime safety-related three Directorates of Sea and Coast Guard, Navigation and Maritime Safety as well as the KANWILs and local operation units.

3.5. "Feasibility Study on Vessel Traffic Management Services" Issued in June 1998 by France

3.5.1. General

This Study Plan was carried out to study the feasibility of the project to attain the following main objectives for Sea Lane Ⅰ and Ⅱ. The Sea Lane Ⅲ is not included in this feasibility study

To attain the foresaid objectives, the project is proposed as follows:

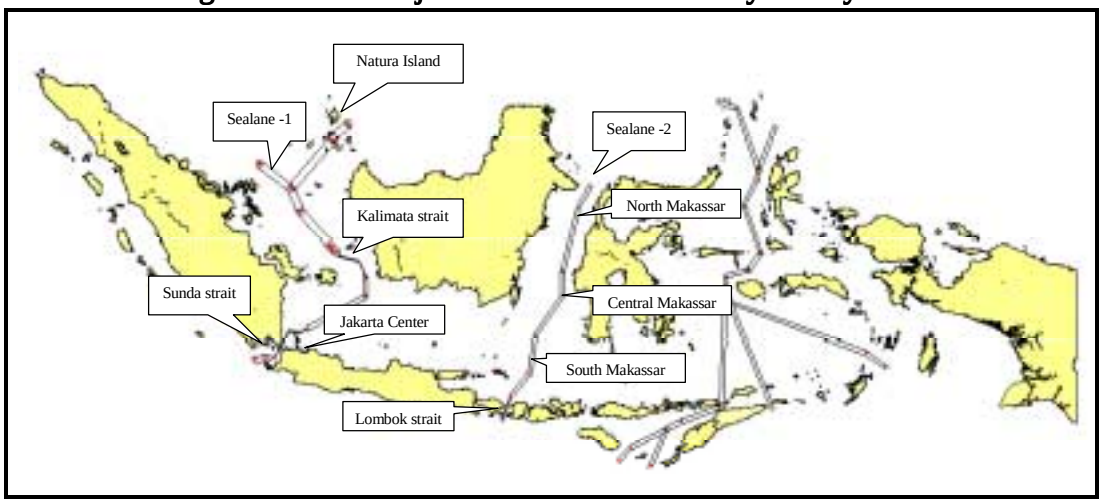
(1) Addition and relocation of Aids to Navigation (Lighthouse, Light beacon, Buoys and Racon).

(2) Establishment of VTS system is comprised of Radar, VHF Radio, Satellite communication link, Operator Console and Engine generator.

3.5.2. Sites of the Project

The project sites will be located as follows:

Figure 3.5.1. Project sites for Feasibility Study for VTS



The Radar, VHF radio and Satellite communication sub-system are installed at each sites excluding Jakarta center site. Operator console with data signal processor is installed to manage the vessels navigating inside sea-lanes. Satellite communication sub-systems are provided to communicate between Jakarta center and other sites.

3.5.3. Description of Project

(1) Name of Project: Feasibility Study on Vessel Traffic Management Services for Strategic sea lanes.

(2) Source of fund: Grant by Government of France through FF.

(3) Targeted Project Area: Sea Lane Ⅰ and Ⅱ

(4) Budget: FF 4,000,000.-

(5) Component of the project:

The project is comprised of two (2) main works as follows:

- Addition of Aids to Navigation.
- Establishment of VTS system.

① Addition of Aids to Navigation

The French consultant recommended the additional Aids to Navigation as follows:

Table 3.5.1. Additional Aids to Navigation recommended by French Consultant

	Sea Lane Ⅰ	Sea Lane Ⅱ	Total
Lighthouse	5	2	7
Light Beacon	10	1	11
Racon	2	0	2
Buoys	1	0	1
Total	18	3	21

Some of the recommended Aids to Navigation by French Consultant is installed for Sea Lane Ⅰ and Ⅱ by German Project.

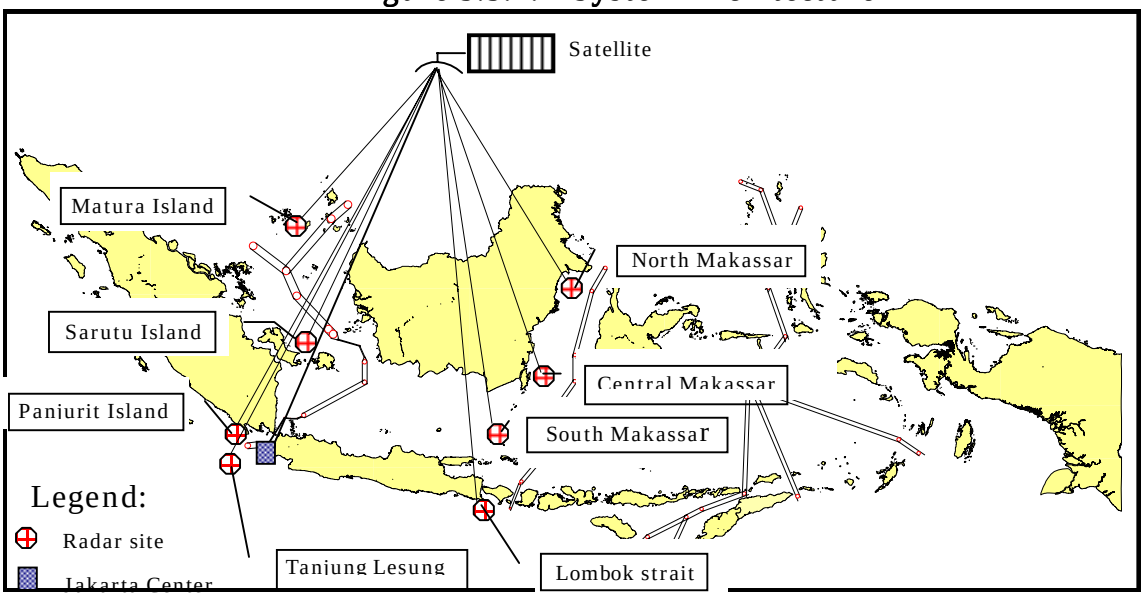
② Establishment of VTS system

The proposed VTS system is comprised of Radar sub-system, VHF communication sub-system, Multiplex Radio Link sub-system, Satellite communication sub-system and Center sub-system.

(6) System architecture

The eight (8) radar VTS sites are located nation widely. One (1) Center site is located at Jakarta DKI. Detailed system architecture is as follows:

Figure 3.5.2. System Architecture



(7) Civil Works

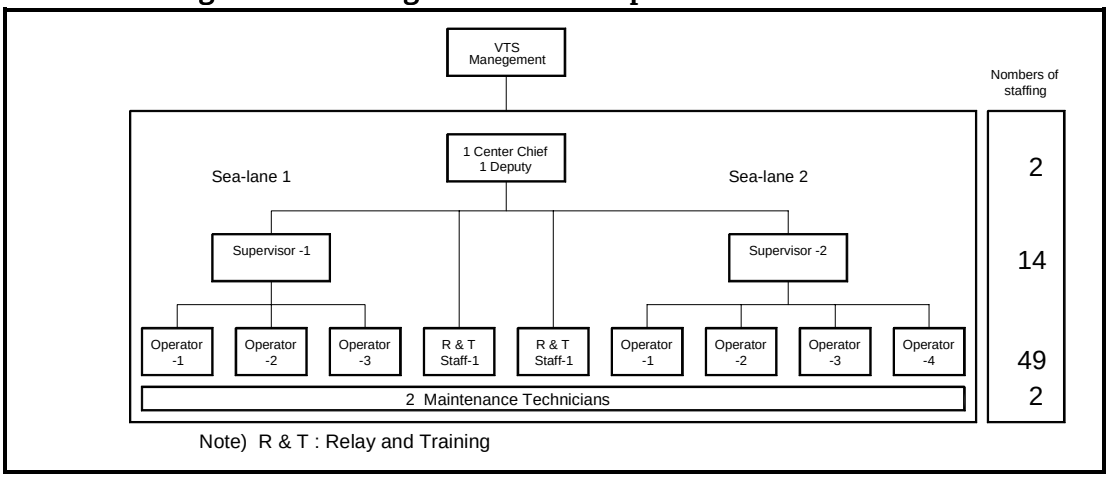
The eight (8) radar VTS sites are located in isolated areas because of technical requirement to attain the objectives of the project. Landing pier and access road should be constructed to transport materials for installation of Radar and equipment house.

(8) Operation, Maintenance and Staff

① Operation and Maintenance

The organization for operation and maintenance of VTS system is shown in **Figure 3.5.3**. The skilled sixty-seven (67) Staffs are required to operate and maintain this VTS system for 24 hours operation.

Figure 3.5.3. Organization of Operation and Maintenance



② Training for operation and maintenance

Various kind of knowledge is required to manage vessels navigating in sea lane for staffs of VTS management group. Three (3) kind of training courses are proposed for upgrading their skills up as follows:

a. Classroom training includes general items related to maritime regulations of sea lane, VTS concepts, IALA Guideline, operation procedure of radar, etc.
b. Job training includes that trainees familiarize actual operation of radar and VHF radio equipment including man-machine interface. This course may be performed with simulator.
c. On-the-Job training includes that trainees familiarize real time operation on the Relay/Training Work station.

(9) Implementation schedule

Implementation of project is proposed to divide into two phases. Each phase consists of the following items.

Phase –1:

a. Sunda Strait for Sea Lane Ⅰ as a strategic input/out.
b. Kalimata Strait for Sea Lane Ⅰ as hazardous sea area
c. Central Makassar for Sea Lane Ⅱ as sea area closed to seashore.
d. Jakarta Traffic Center

Phase-2:

a. Natuna island area for Sea Lane Ⅰ
b. South and North Makassar areas, to complete traffic management in Sea Lane Ⅱ in hazardous areas and in input-output area.
c. Additional equipment for Jakarta Traffic Center.

(10) Project cost

Summary of estimated project cost is proposed as follows:

Table 3.5.2. Equipment and Installation Cost including Civil Work Cost

Unit: Thousand US$

	Phase-1	Phase-2	Total
Total investment cost	**27,328**	**14,186**	**41,514**

Note) This estimated cost includes foreign and local cost. Local cost is converted to US Dollar (US$).

3.5.4. Present Status of the Project.

Final Report of this Feasibility Study was submitted on June 1998 to DGSC. German Project realizes some of Aids to Navigation proposed by this report. On the other hand, the result of this feasibility study for implementation work of VTS system is reported to Ministry of Communications to secure budget. This work is not yet proceeding as of December 2001.

3.6. "Special Assistance for Project Sustainability for Maritime SAR Telecommunication System Project" in March 2000 by JBIC

Along with the Report for "The Study on Maritime Safety Plan concerning Search and Rescue" issued in February 1989 by JICA, DGSC implemented "Maritime SAR Telecommunication System Project (' Project' hereinafter)" and completed it in March 1992.
Telecommunication system for maritime search and rescue in Indonesia has been improved by the Project, but after several years of the Project's completion, the system was not fully functioning mainly due to mainly shortage of maintenance budget and engineers.

The Special Assistance for Project Sustainability (SAPS) program of the Japan Bank for International Cooperation (JBIC), is a grant assistance scheme designed to ensure the maximum possible attainment of the intended benefits of projects financed by JBIC and enhancement of their sustainability. Under the SAPS program, JBIC SAPS team was formed to address the points relating to the improvement of proper implementation of the Project and recommended measures for enhancing the sustainability of the Project.

SAPS team, taking into consideration the present status of the maritime SAR telecommunication system and the maritime SAR operation including the recent trend of marine traffic in Indonesian waters, recommended the following subjects to be developed urgently;

(1) Implementation of GMDSS in the Entire Sea Area of Indonesia.
(2) Reinforcement of Traffic Safety and Surveillance System by VTS/AIS System for the Malacca Straits.
(3) Functional Rehabilitation of the Maritime SAR Telecommunication Network
(4) Enhanced Performance and Optimum Deployment of Rescue Vessels
(5) Reinforcement of Maintenance System for the Telecommunication System
(6) Improvement of Command Ability for SAR Operation at DGSC.

3.7. "Basic Design Study Report on the Project for Rehabilitation for Medium Wave Radio Beacon Stations in the Republic of Indonesia" (Nov. 2000)

3.7.1. Background of the Study

Eighteen (18) Medium Wave Radio Beacon (MFB) Stations were established by Japan's Yen Loan of 1982 fiscal year in order to secure navigation safety and promote efficiency of sea traffic in the waters with large traffic volume in Indonesia.

However, most MFB stations had almost stopped their operation by 1996. Major reasons were failures of power supply system. They were not recovered because of weak management and maintenance system including a lack of budget for operation and maintenance. In addition, complex factors such as difficulty of accesses to the sites, lightning attacks, salty wind and rain. It could not be estimated at the time of planning construction.

In connection with the MFB stations, the International Maritime Organization (IMO) and the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) have a concept to introduce Differential GPS (DGPS) for the improvement of ship positioning accuracy as a global system.

Many of the MFB stations in the world were changed to DGPS stations, and exclusive MFB stations without DGPS have been closed.

Some DGPS stations have been operated by the neighboring countries of Indonesia in Malacca and Singapore Straits and the waters around. Singapore operates one (1) station, Malaysia operates two (2) stations and India operates one (1) station at least around the straits.

On the other hand, Indonesia has established three (3) strategic sea lanes, that is, Sea Lane Ⅰ, Sea Lane Ⅱ and Sea Lane Ⅲ around Sunda Strait, Lombok Strait and other waters respectively.
Indonesia has approved that foreign warships and other vessels can freely navigate in the sea lanes as parts of Indonesian waters since 1998.
The extension of the Traffic Separation Scheme (TSS) and the introduction of Ship Reporting System at Malacca Singapore Strait were decided.
Based on these points, Indonesia has been stressing the policies as a maritime country.

Under these circumstances, the development of aids to navigation facilities,

which is the basis of securing navigation safety, has become important.
It was expected that the function of MFB stations, which is available for twenty-four (24) hours under all-weather condition, would be voluntarily recovered by Indonesia.
However, it became difficult to recover early the function of MFB station because of economy crisis of Indonesia.

Therefore, the Government of Indonesia (GOI) requested Japan's Grant Aids based on the Project for Rehabilitation for Medium Wave Radio Beacon Stations according to the international trend of IMO and so forth, to the Government of Japan on March 1999.

Based on the request of GOI, "Basic Design Study Report on the Project for Rehabilitation for Medium Wave Radio Beacon Stations in the Republic of Indonesia" (Report) was prepared by the JICA on November 2000.

The project areas covered by seven (7) stations in the project are faced to the most important waters. Those MFB stations to be rehabilitated in the project are to be re-located and co-sited with the existing Coastal Radio Station in order to secure proper operation and maintenance.

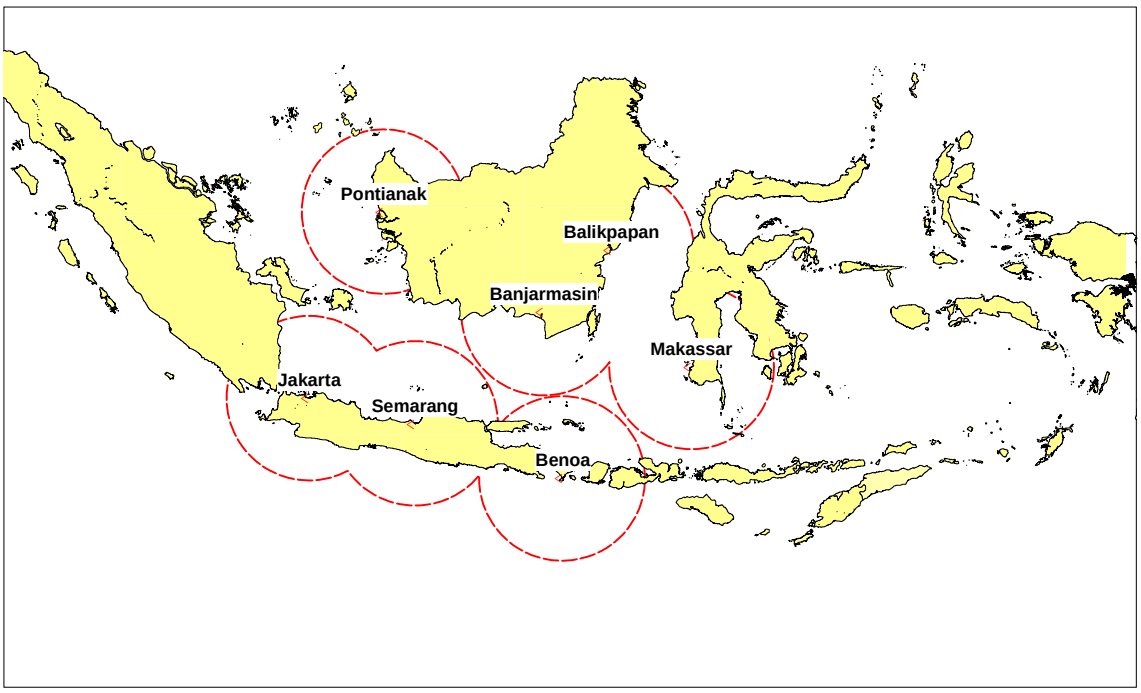
3.7.2. Outline of the Project

In the technical aspect, the seven (7) sites planned for the project shown in **Table 3.7.1**. and **Figure 3.7.1.** had been judged to be appropriate for implementation of the Project.

Table 3.7.1. Site Location of DGPS Stations

DGPS Station	Coastal radio Station	Latitude	Longuitude
Jakarta	Jakarta (TX station)	S 06 ° 07' 08"	E 106 ° 51' 47"
Semarang	Semarang (TX station)	S 06 ° 58' 34"	E 110 ° 20' 35"
Benoa	Benoa	S 08 ° 44' 35"	E 115 ° 12' 34"
Makassar	Makassar (TX station)	S 05 ° 06' 22"	E 119 ° 26' 31"
Balikpapan	Balikpapan (TX station)	S 01 ° 16' 12"	E 116 ° 48' 32"
Banjarmasin	Banjarmasin (TX station)	S 03 ° 18' 09"	E 114 ° 34' 38"
Pontianak	Pontianak	S 00 ° 01' 16"	E 109 ° 19' 02"

Figure 3.7.1. Location Map of DGPS Stations



(1) Operation and Maintenance Management System

In the Project for rehabilitation of the existing MFB stations, the study of project sustainability had been implemented as one of the most important issues.

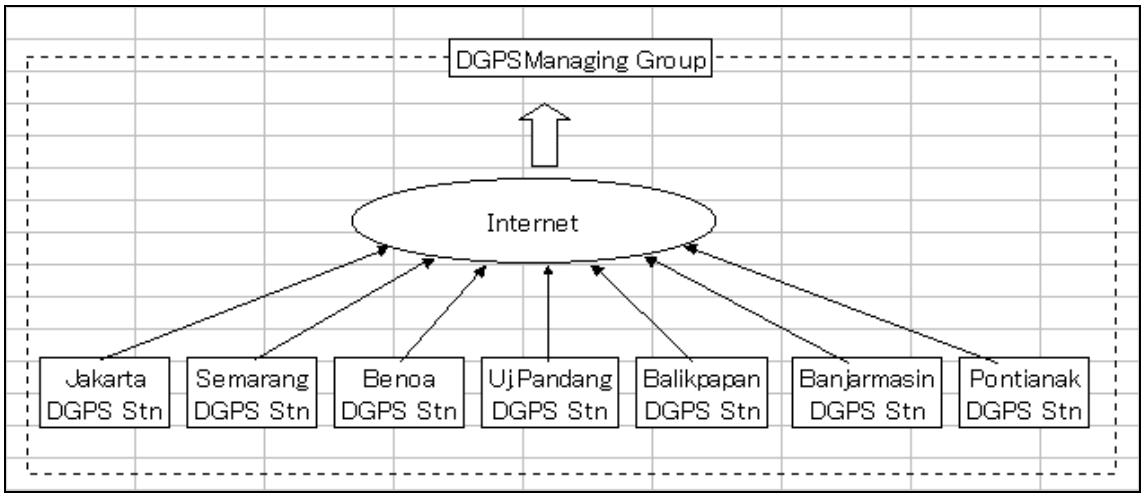
As a result, the Indonesian counterpart explained that the plan of raising the fund for the operation and maintenance costs for the aids to navigation-related facilities from the Light Dues enforced in June 2000.

For the operation and maintenance system, the Plan of DGPS Operation and Maintenance System as shown in **Figure 3.7.2**. had been drafted.

In this plan, the DGPS Managing Group having overall responsibility for the operation and maintenance of the system would be established in DGSC, MOC and at least two dedicated maintenance technicians would be assigned to each DGPS station.

Therefore, it was deemed that the continuous and stable operation and maintenance of the system would be secured.

Figure 3.7.2. DGPS Operation and Maintenance System Plan



3.7.3. Operation and Maintenance Cost of DGPS Stations

The operation and maintenance cost of DGPS stations in Indonesia to be operated by DGSC after the completion of the project has been estimated as shown in **Table 3.7.2.**

Table 3.7.2. Operation and Maintenance Cost of DGPS Stations

Unit: Thousand Rupiah

Item	Amount
1. Personnel expenses	175,200
(1) DGPS managing group	57,600
(2) DGPS stations	117,600
2. Operation and maintenance cost	335,243
3. Traveling cost	30,620
Total	541,063

The light dues newly introduced in year of 2000 has been strongly expected for operation and maintenance for aids to navigation and their related matters in the future.

Also, the light dues would provide the operation and maintenance cost for the DGPS system except the personnel expenses mentioned above.

3.7.4. Suspension of Implementation of the Project

This project has been suspended for the following reasons:

(1) SA Termination

The US Administration announced hastily on May 1, 2000 to the users of Standard Positioning Services (SPS) that the Selective Availability (SA) intended for GPS positioning with a lower accuracy than that for military use

was terminated at midnight on May 1, 2000.

As a result, the GPS positioning accuracy was globally enhanced around 10 times as high as before. the US Administration has declared that "Users in the US and the rest of the world should now be experiencing the same basic GPS accuracy of 10-20 meters or better.

The GPS positioning accuracy at the time of the request of Grant Aids of Indonesia, namely before the SA termination, was about 100m. By the SA termination, the GPS accuracy had been enhanced to around 10m. As a large change appeared in the background situation for the request of Indonesia.

(2) Confirmation of accuracy of GPS system

For the reasons of SA termination above mentioned, the precise discussion on the GPS positioning accuracy after SA termination should be made based on the measurement and analysis considering the following points:

① Error measurement considering the model difference of GPS receivers,
② Error measurement for a long time considering seasonal changes, and
③ Confirmation of static and dynamic accuracy.

The result of analysis for the measurement of GPS accuracy in Indonesia is described in **Section 6.1. of Chapter 6**.

(3) Check on the conditions for introduction of light dues

For the light dues newly introduced to utilize for the operation and maintenance of aids to navigation services and their related matters, it was deemed to be necessary for the following points:

① to check the conditions of the established system including the system of reporting on the light dues within the Indonesian Government; and
② to fully verify the light due amount and its distribution plan that had originally been estimated.

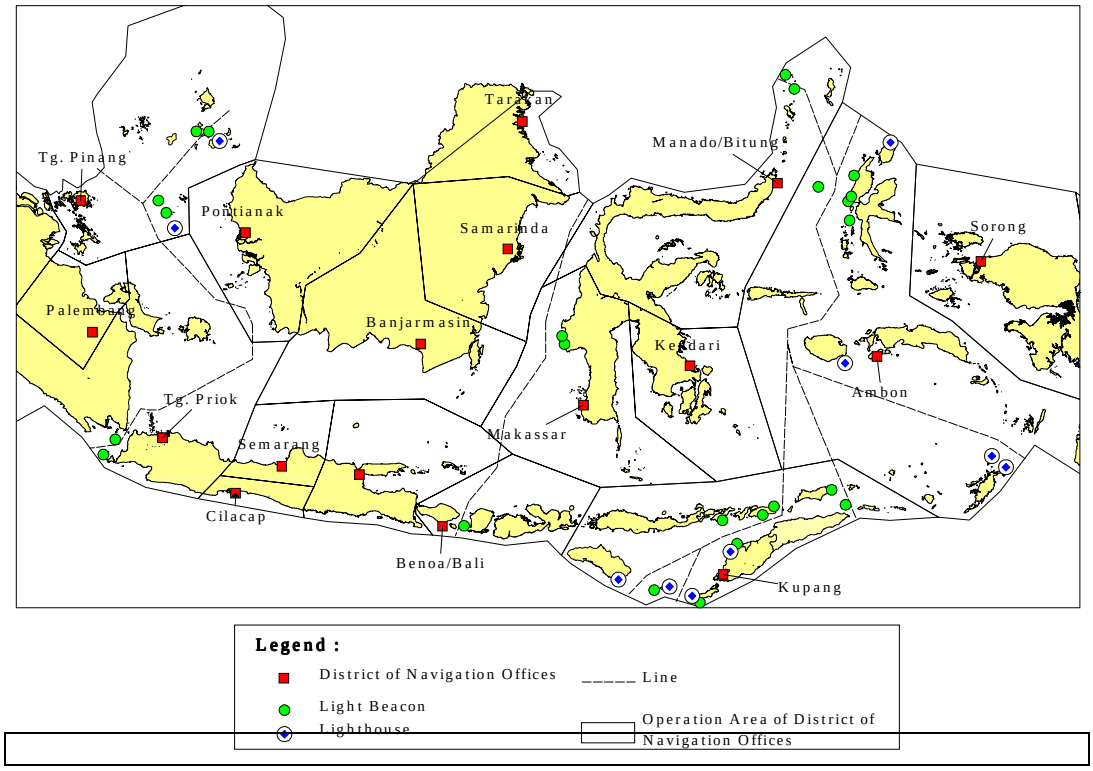
3.8. "Navigational Safety Project in Indonesia" in June 2001 by German Bank

3.8.1. General

German loan project is on-going project including installation works engaged by the German Bank of Reconstruction (KfW), based on the Master Plan on the Development of Aids to Navigation System in the Republic of Indonesia, October 1985 with long-term plan up to year of 2000.

The project locations are allocated in the waters around three international Sea Lane Ⅰ, Ⅱ and Ⅲ as shown in **Figure 3.8.1.**

Figure 3.8.1. Location Map of Navigation Safety Project in Indonesia



The main target of this project is to improve the safety of maritime traffic and to fulfill the obligations with respect to international conventions and regulations e.g. the International Maritime Organization (IMO) and International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA).

3.8.2. Project Description

The aids to navigation including supporting facilities to be implemented in this project are as follows;

(1) Name of project : Navigational Safety Project in Indonesia
(2) Source of fund : Provided by the Government of Germany through KfW
(3) Loan agreement : No. 1999 65 450 (Loan amount: 42 million DM)
(4) Project Period : Within 18 months after the day of issuance of Notice to Proceed.
(5) Project type : Tied loan including installation works
(6) Composition
① Lighthouse : 11 units (40m galvanized steel lattice tower)
② Light beacon : 10 units (30m galvanized steel lattice tower)
③ Light beacon : 5 units (20m galvanized steel lattice tower)
④ Light beacon : 8 units (10m galvanized steel lattice tower)
⑤ Light buoy : 119 units
⑥ Workshop equipment : 5 units
⑦ Remote control equipment : 3 locations
⑧ On-the-job and factory training : 1 lot

(7) Project area for this project:
There are seven (7) project areas of the District of Navigation Offices, which are six (6) DISNAVs of Tanjung Pinang, Benoa, Tanjung Priok, Makassar, Manado/Bitung, Kupan, Ambon and one (1) Sub DISNAVs of Pontianak.

3.9. Technical Co-operation in the Field of Maritime Safety Operation and the Information Technology in November 2001 by JICA

In a few years, the problems of piracy and armed robbery to ships has become more serious in Indonesian waters, especially in the Strait of Malacca. In case of taking countermeasures to piracies, one of the most important issues is how to get information and deal it.

Responding to the request from the Government of Indonesia, JICA dispatched three short term experts in the field of maritime safety, radio and computer from September 2001 to November.

The JICA experts set up Maritime Safety Information System (MSIS) based on personal computers and internet at the major DGSC district offices in the Strait of Malacca and Singapore, and DGSC headquarters in Jakarta in cooperation with DGSC counterparts.

After the installation of the system at each office, they gave training on the operation of the system to the officials in charge of maritime safety including anti-piracy.

MSIS enabled DGSC to exchange piracy information among Belawan, Dumai, Tanjung Uban, DGSC headquarters, International Maritime Bureau (IMB) Piracy Reporting Center, and other domestic and international security organizations.

CHAPTER 4.
COLLECTING SYSTEM OF LIGHT DUES

4.1. Background of introduction of Light Dues

Main duties of DGSC are to carry out services related to versatile maritime safety fields based on the policies determined by Minister of Communications, Republic of Indonesia. DGSC has responsibilities for aids to navigation and maritime telecommunication services in maritime safety field.

In order that Indonesia may be able to fulfill its international responsibility as one of the signatories of the SOLAS Convention for keeping safety of navigation and promoting efficient maritime traffic in the Indonesian territorial waters, it is required to upgrade, in quality and quantity, infrastructure for safe navigation as follows;

- Aids to navigation,
- VTS,
- Maritime telecommunications,
- State ships and workshops for supporting operation and maintenance of aids to navigation, and
- Jetties and docks mainly to carry out operation and maintenance of state ships.

On the other hand, the routine budgetary situation in the Directorate of Navigation, DGSC from fiscal year 1998 to fiscal year 2002 except personnel expenses and traveling expenses is shown in **Table 4.1.**

Table 4.1. Operation and Maintenance Budget on Directorate of Navigation

Unit: Million Rupiah

Item	1998/99	1999/00	2000	2001	2002
Actual Budget	34,879	38,329	29,904	33,225	-----
Requested Budget		109,300	61,442	58,225	93,897
Acquisition Ratio		35.07%	48.67%	57.06%	-----

Data Source: DGSC, Fiscal Year 2000: April 1 to December 31

As shown in the current budgetary situation, it is scarcely expected to get budget for those purposes of DGSC from general account.

The actual budget from general account in 1999 was cut down to about 35% of

requested budget since the economic crisis started in 1998.

Therefore, the light dues system was introduced in May 2000 and started collection in June 2000 as a special account for supplementary budget.

4.2. Outline of Light Dues

4.2.1. Light Dues

The light dues are one of non-taxation State Revenue consists of three kinds of charge for the following navigation services;

- Services of Marine Aids to Navigation,
- Rental services of navigation shipyard facilities, and
- Maritime telecommunication services.

4.2.2. Imposition of Light Dues

(1) Vessels to be applicable to the light dues

The light dues are imposed on the international sea transportation vessels, domestic sea transportation vessels and passenger vessels or pioneer vessels that are navigating in Indonesian waters.

It is calculated based on gross tonnage of a vessel, and collected from every vessel who calls at a sea port or special port or ferry port or the other prescribed location according to the related laws and regulations in Indonesia. The light dues, however, is not imposed on the following vessels:

- The vessel which only passes the Indonesia waters,
- The state vessel which is used for government duties,
- War ships,
- Hospital ships in war condition,
- Vessels of less than 35 gross tons,
- The vessel which enters a port requesting for help/rescue or the vessel which gives help/rescue to human life,
- The vessel which is on sea trial, and
- Private vessel which is on government duties.

(2) Tariffs of light dues

The following light dues are imposed on every vessel that conforms to Attachment No. II B of Government Regulation No. 14 in year 2000 concerning Tariffs on Non-taxation State Revenue that is currently valid in Ministry of Communications;

① For the vessel of foreign flag : US$0.027 per gross ton

② For the vessel of Indonesian flag : Rp.200.- per gross ton

③ For the traditional/ pioneer ship : Rp.100.- per gross ton

(3) Management of light dues

The light dues as Non-taxation State Revenue are required to be immediately deposited to government treasury and be managed in the system of National Revenue and Expenditure Budget.

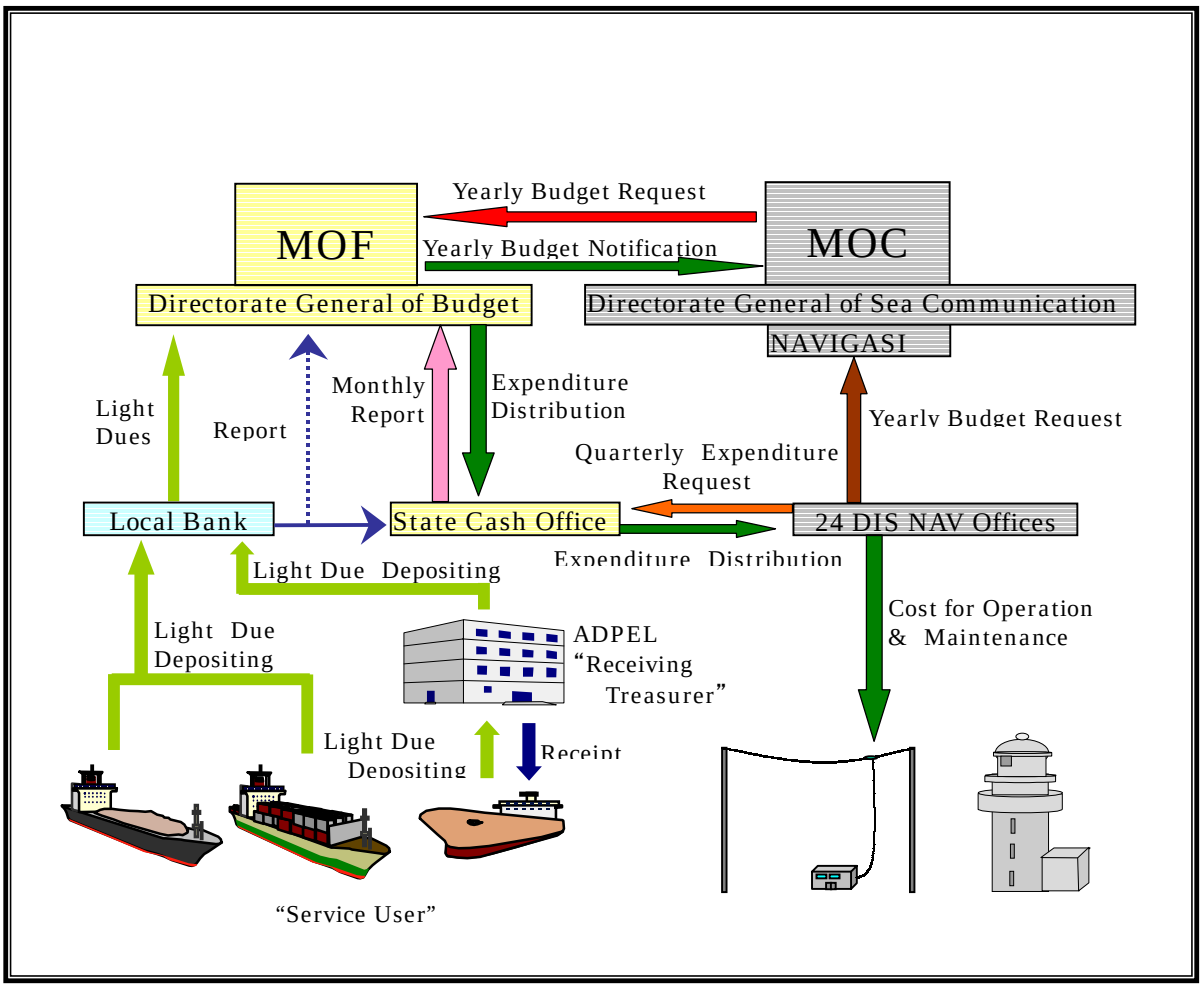
4.3. How to Collect the Light Dues

The collection of light dues as Non-tax State Revenue is carried out according to the followings;

(1) To be deposited directly to the State Cash Office immediately
(2) To be managed in the State Budget System
(3) To be deposited to State Cash Office by the service user or the receiving treasurer appointed by the Minister
(4) To be collected and deposited by using a form as evidence.
(5) To be a deposit form which is decided by the Minister of Finance
(6) To be a form of receipt/debit note for collection which is decided by Director General
(7) To be reported on receiving and depositing every one month at the latest on the 10th of the next month.

The receiving, depositing, reporting and distribution of light dues are implemented as shown in **Figure 4.1.**

Figure 4.1. Flow Chart on Collecting System of Light Dues & its Distribution



4.4. How to Spend the Collected Light Dues

4.4.1. Scope of Utilizing Light Dues

The utilizing part of fund born from Non-taxation State Revenue (PNBP), i.e. light dues, which comes from revenue of navigation services at the Directorate of Navigation, DGSC was permitted by the Decree of Minister of Finance Republic of Indonesia, Number 306/KMK.06/2001 on May 17, 2001.

The light dues as revenue from navigation services can be re-utilized up to 50% at the same fiscal year to finance the following services:

(1) Research and development in the field of navigation technology,

(2) Upgrading of human resources in order to improve service quality to the public,

(3) Law enforcement for keeping order, supervising, controlling and securing as well as maritime safety in Indonesian waters,

(4) Investment relating to facilities and infrastructures for safe navigation

such as facilities of marine aids to navigation, maritime telecommunication, state ships, workshops, piers and dockyards for services to the public, and

(5) Maintenance and repair for office/building and other equipment relevant to navigation services.

There is a ceiling up to 50% for utilizing of light dues in the fiscal year 2001 because it was the first year for the procedures on the budgetary allocation for utilizing of light dues after light dues system was introduced. It is expected that the ceiling for utilizing of light dues will increase in the near future.

4.4.2. Actual Allocation for Utilizing Light Dues

The actual allocation on utilizing of light dues in the fiscal year 2001 is shown in **Table 4.2.**

Table 4.2. Actual Allocation for Utilizing Light Dues

Unit: Thousand Rupiah

Allocation Category	Amount	Ratio
Procurement for Operation	22,890,630	43.54%
• Office supply, communication fee, documentation	148,900	0.28%
• Equipment for Operation and Maintenance	6,787,493	12.91%
• Utilities (Light, Gas, Water, etc)	783,120	1.49%
• Indirect services	15,171,117	28.86%
Procurement for Maintenance	28,622,017	54.44%
• Maintenance for Office Building	84,107	0.16%
• Maintenance for Minor Transportation Equipment	4,000	0.01%
• Maintenance for Aids to Navigation and Supporting Facilities, i.e. - Vessels for Aids to Navigation Services - Spares for Aids to Navigation & Supporting Facilities and Coastal Radio Stations - Fuel supply for Vessels, and so forth	28,533,910	54.27%
Others	1,063,204	2.02%
• Human Resources	229,200	0.43%
• Traveling	834,004	1.59%
Total Amount	52,575,851	100%

Data Source: DGSC

The actual allocation of budget from the light dues was approved by the Ministry of Communications and Telecommunications at the end of August 2001 through sufficient approval procedures and time because it was the first time for Indonesia to officially utilize the light dues.

The budget from light dues in the fiscal year 2001 can be utilized during the period from September 2001 to December 2001.

The allocation ratio of the procurement of equipment for operation and maintenance is 12.91% of the total amount because budgetary period of four (4) months is insufficient for the tendering procedures for the procurement. The budgetary period of the fiscal year 2002 will start from February 2002.

4.5. Monthly and Annual Revenue of Light Dues

4.5.1. Estimated Revenue of Light Dues for fiscal Year 2001

For the fiscal year of 2001, Directorate of Navigation, Directorate General of Sea Communication, Ministry of Communications has estimated total amount of light dues during 12 months, in Indonesian Rupiah 130,948,712,800.- (approximate 1,702 million Japanese Yen).

4.5.2. Total Amount of Light Dues Collected from January 2001 to December 2001

As of January 2, 2002, the total amount of light dues collected from January 2001 to December 2001 is figured out in Indonesian Rupiah 112,808,434,999.07.-, which was deposited through the local banks, based on data source of Directorate of Navigation, Ministry of Communications. It is equivalent to approximate 1,466 million Japanese Yen or approximate 11.280 million US Dollars.

The total amount consists of Indonesian Rupiah 77,666,789,605.07 as local Currency and US$3,464,388.99 equivalent to Indonesian Rupiah 35,141,645,394.- as foreign currency.
The total gross tonnages of vessels, which paid the light dues, are approximate 516,644,000GT, which consists of approximate 388,334,000GT of vessels paid in local currency and approximate 128,310,000GT of vessels paid in foreign currency.

This total amount, however, does not include the amount of light dues to be collected from Vessels of State-Owned Oil Company (PERTAMINA) and Indonesian National Shipping Company (PELNI).

They own visual aids to navigation independently established at and around some ports and where their vessels regularly visit. Those visual aids to navigation are operated and maintained by them.

As a result, the total amount of light dues figured during above twelve (12) months is about 86 % of the estimated revenue for the fiscal year 2001 mentioned in **Section 4.5.1.**

CHAPTER 5.
ESTABLISHMENT OF INVENTORY FOR FACILITIES

5.1. Facilities of Aids to Navigation

The current situation of the facilities concerning the aids to navigation services was confirmed through the site survey in the Study for the areas of the following District of Navigation Offices (DISNAV/Sub DISNAV) and their related aids to navigation facilities. The current situation of facilities on aids to navigation services was confirmed through the Site Survey carried out by the JICA Study Team and the preparation of Inventory on aids to navigation services was executed by the local consultant.

The result of the survey on current situation is summarized for the visual and radio aids to navigation and their supporting facilities as follows;

(1) Current Situation of Visual Aids to Navigation

The following visual aids to navigation Indonesia are operated and maintained by twenty-four (24) District of Navigation Offices (DISNAV/Sub DISNAV) under Directorate General of Sea Communication (DGSC) ;

① Lighthouses 235 units
② Light Beacon (incl. 7 units of RLB) 1,168 units
③ Light Buoy 332 units
④ Un-Light Beacon 260 units
⑤ Un-light Buoy 103 units

(2) Current Situation of Radio Aids to Navigation

The following radio aids to navigation Indonesia are maintained by twenty-two (22) District of Navigation Offices (DISNAV/Sub DISNAV) under Directorate General of Sea Communication (DGSC) ;

① Medium Wave Radio Beacon Stations (MFB) 18 stations
② Radar Beacon Stations (RACON) 84 stations
③ Differential Omega 5 stations

(3) Current Situation of Supporting Facilities

The following supporting facilities for the aids to navigation services in Indonesia are operated and maintained by twenty-four (24) District of Navigation Offices (DISNAV/Sub DISNAV) under Directorate General of Sea Communication (DGSC) ;

① Vessels for aids to navigation services 75 units
a. Buoy tenders (6 units)
b. Aids tender (57 units including 4 supply vessels)
c. Inspection boat (11 units)

d. Survey vessel (1 units)

② Buoy bases with Jetty 8 units

③ Workshop 25 units

④ Acetylene gas plant 1 units

(4) Current Situation of Management of Light

① Management of facilities

The working area of District of Navigation Offices (DISNAV/Sub DISNAV) was decided by decision of Director General of Sea Communication; UM/48/9/2-88 dated February 9, 1988. Each District of Navigation Office should follow this decision on operation and maintenance including management of their assets.

The assets such as lighthouse, light beacon and light buoy on development project have been followed this decision since 1989. However, there are some lighthouses and light beacons, which are not registered at actual DISNAV as the assets of DISNAV before year of 1988.

Those aids to navigation should be urgently exchanged between or among the DISNAVs concerned in order to avoid wasteful operation and maintenance.

② Management of No. of List of Light (Daftar Suar Indonesia : DSI)

There are some ghost aids to navigation with No. of List of Light, which had already collapsed and do not exist. Those lights still are on the nautical charts, which were bought at the hydrographic office for this study. The several lights of those, which locate at critical waters, should be promptly rehabilitated for the safety of mariners.

5.2. Facilities of Telecommunications System

5.2.1. Current Situation of the Facilities by Site Survey

The Study Team visited seven (7) 1st class , six (6) 2nd class, five (5) 3rd class and one (1) 4th class coast stations and the competent District NAVIGASI and ADPEL to make site survey to grasp current situations on operation, maintenance, personnel training, facilities and equipment relating to coast stations and the maritime SAR telecommunications systems which have been built by DGSC all over Indonesia.

The remarkable points on the equipment and facilities indicated by the survey are as follows:

(1) As for GMDSS shore-based facilities, there still remain many blind zones to be covered by MF DSC and VHF DSC.
The expansion of GMDSS coverage should be studied.

(2) Although Teluk Bayur and Benoa stations are located at key spots for maritime safety and has many links with other coast stations, both stations have been operated at a single site where the transmitters and the receivers are collocated.
The necessity for separation transmitting and receiving station should be studied.

(3) In Surabaya and Makassar coast stations, noises caused by city activities are very big, these are unsuitable for the environment of receiving stations.
Furthermore, the transmitting and receiving sites of Surabaya station and the receiving site of Makassar station are too limited space to ensure the antenna system of 1st class station.
The above matters should be considered and improved.

(4) Dumai coast station can not communicate with the vessels passing the Strait of Malacca by VHF because of a big Rupat island existing in front of Dumai port.
Samarinda station is located about 30 km upriver from sea and so VHF area cannot be covered sufficiently.
These matters should be considered and improved.

(5) DGSC headquarters moved to present 25-story MOC building in 1997 and the Message Center has been remained in the old building. It should be re-established and modernized as an Information Center.

(6) Some DGSC's regional offices are under discussion of autonomy policy in Indonesia.
Re-construction of district communication network for the reorganized DGSC's regional offices should be considered.

(7) Most engine-generators and antennas of the 1st and 2nd class coast stations are old, and they should be improved.

5.2.2. Establishment of Inventory

The establishment work was carried out by a local consulting firm under an agreement with the Study Team.

The agreement was concluded on May 3, 2001 between the Study Team and the local consultant based on the "Specifications for Drawing up The Inventory of The Maritime Telecommunication Facilities" which was approved by JICA.

The investigation for the inventory was made on 221 coastal radio stations and 48 district offices such as DISNAV, KANWIL and ADPEL/KPLP, by means of questionnaire, actual field survey, interview with DGSC's personnel and in cooperation with the Study Team members and DGSC headquarters' personnel.

The local consultant has edited the results as,

Maritime Telecommunication Facilities;
Inventory, Plant Records and Outlook-2001 (Volume 1 - 4)

And this document (in 50 copies) was submitted to DGSC on November 15, 2001.

CHAPTER 6.
CURRENT SITUATION OF GPS AND DGPS

6.1. Measurement of Accuracy of GPS

This work was carried out to confirm accuracy of GPS after the removal of Selective Availability (SA) for the following points:

① Measurement of static positioning error
② Confirmation of model differences based on the static positioning error
③ Confirmation of model differences based on the dynamic positioning error
④ Confirmation of seasonal change of static positioning error in dry and rainy season

6.1.1. Static Error

(1) Period of the measurement

① The first measurement :May 06, 2001 to May 30, 2001 (25days)
② The second measurement :May 31, 2001 to June 30, 2001(31days)
③ The third measurement: :October 21 2001 to November 21 2001 (31days)
④ The fourth measurement :December 19 2001 to January 10 2002 (32days)

(2) Circumstances required for the measurement

Measuring system such as GPS Receivers was equipped on the top of the transmitting station building where co-ordinate was decided precisely. The transmitting station is located at Coastal Station in Tanjung Priok Jakarta. Measuring work was carried out continuously by 24hour basis and result was stored into PC (data recording system) by dual system.

(3) Procedure of analysis

Measured data for five (5) GPS Receivers was analyzed as follows:

① Calculation of absolute distance (x) from Standard co-ordinate.
② Creation of Histogram by distance (x) and frequency.
③ Calculation of distance (L) by 95%probability and
④ Calculation of Standard distribution (SD) and Valiance (V).

(4) Result of analysis

① Four times of measurement works were carried out on May, June, October and December of year 2001 in Indonesia. The measured data was analyzed and calculated into the mean error by cumulative probability method for each five (5) GPS Receivers. Error of monthly analysis is shown in **Table 6.1.1. and Figure 6.1.1.**

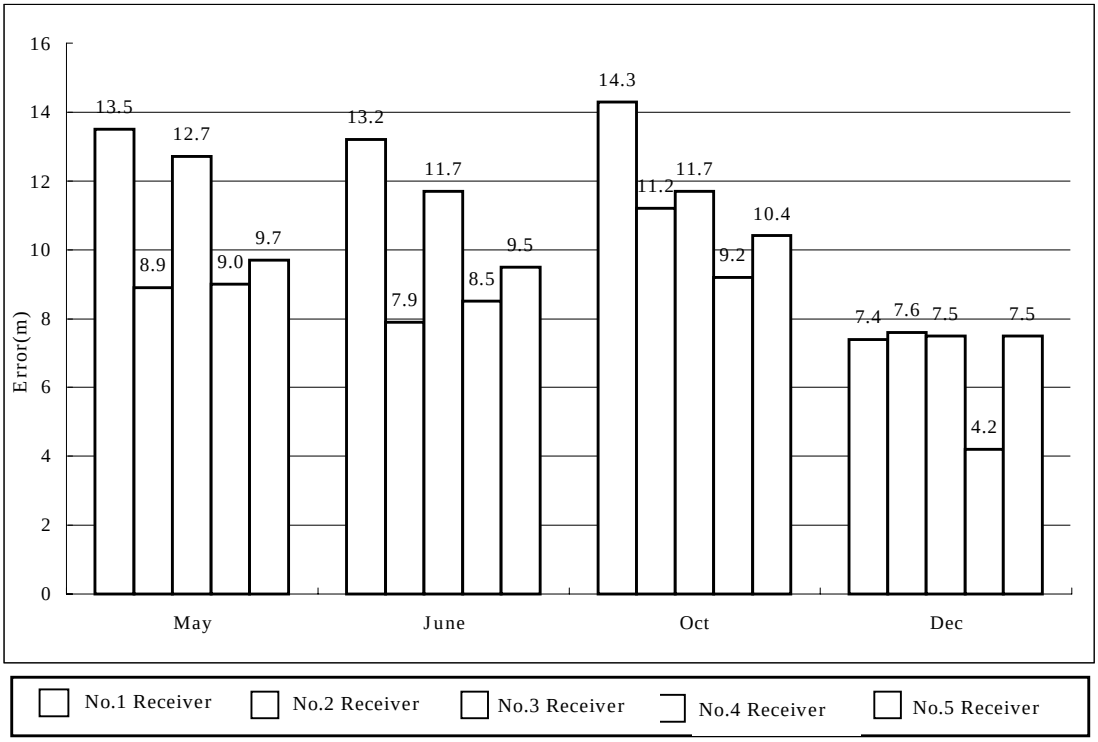
② Result of Static Error

The 95% cumulative error was calculated upon adoption of all data of five (5) GPS receivers. The 10.5m static error is delivered from its calculation result and adopted as Static error for the Study.

Table 6.1.1. Error for Monthly Analysis (Static Accuracy)

Lot number of GPS Receiver	Measurement duration		Nos. of data	95% cumualtive probability (m)
	Commenced date	Finished date		
No.1 GPS Receiver	06-May-01	10-Jan-01	915,893	13.1
No.2 GPS Receiver	06-May-01	10-Jan-01	915,388	8.9
No3 GPS Receiver	06-May-01	10-Jan-01	1,001,855	11.6
No4 GPS Receiver	06-May-01	10-Jan-01	5,063,665	8.7
No.5 GPS Receiver	01-May-01	10-Jan-01	4,435,154	9.4

Figure 6.1.1. Error for Monthly Analysis (Static Accuracy)



6.1.2. Dynamic Error

(1) Period of the measurement

Measurement works were carried out in accordance with schedule specified as follows:

① Measurement by car : July 2, 2001 to July 7, 2001 (6 days)

② Measurement by ship : July 9, 2001 to July 12, 2001 (4 days)

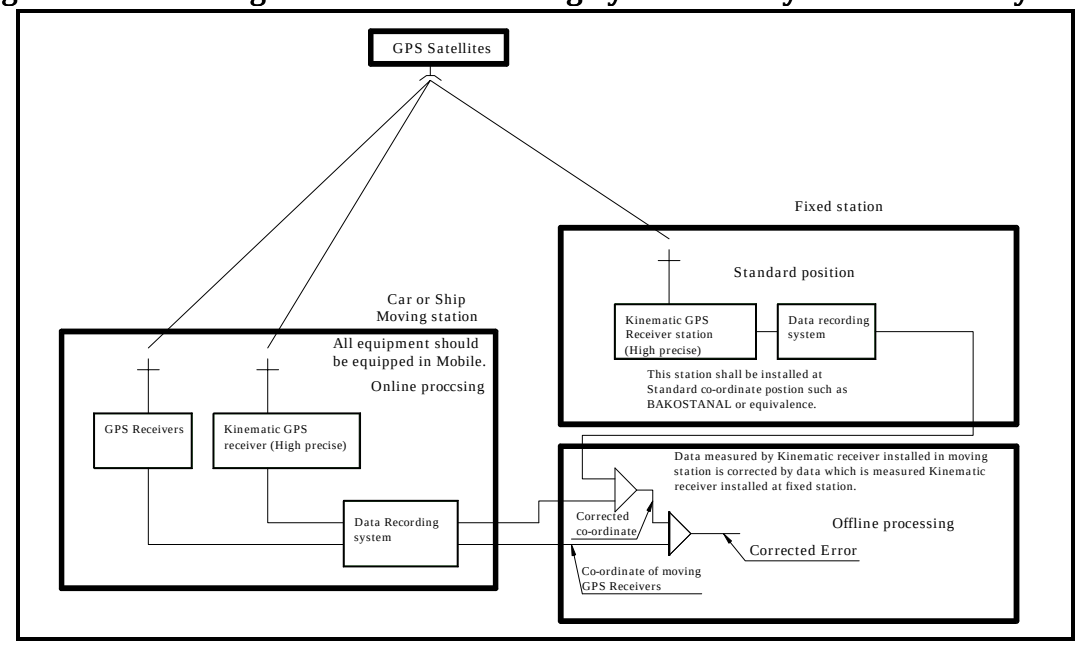
③ Measurement by car : December 03, 2001 to December 04, 2001 (2 days)

④ Measurement by ship : November 27, 2001 to November 27, 2001 (1 day)

(2) Circumstances required for the measurement

Five (5) GPS Receivers were equipped in Car and Ship. Configuration of measuring system is shown as follows:

Figure 6.1.2. Configuration of measuring system for Dynamic accuracy



(3) Measuring circumstance

① Sailing by ship : Offshore Jakarta. Measuring work was done on sailing speed such as 5, 10, 15 and 20 knot.

② Moving by car : Between Karangampel and Cirebon. Measuring work was done on curising speed that is 10, 20, 30, 40, 50, 60, 70, 80 and 90km/h.

(4) Method of analysis

Measured data for five (5) GPS Receivers was analyzed as follows:

① Calculation of absolute distance (x) from Standard co-ordinate.

② Creation of Histogram by distance (x) and frequency.

③ Calculation of distance (L) by 95%probability and

④ Calculation of Standard distribution (SD) and Valiance (V).

(5) Result of analysis

Error was measured on each speed for five (5) GPS Receivers. Error for each speed is shown in **Figure 6.1.3. and Figure 6.1.4.**

Figure 6.1.3. Error of Each GPS Receiver per Speed (Dynamic Accuracy by car)

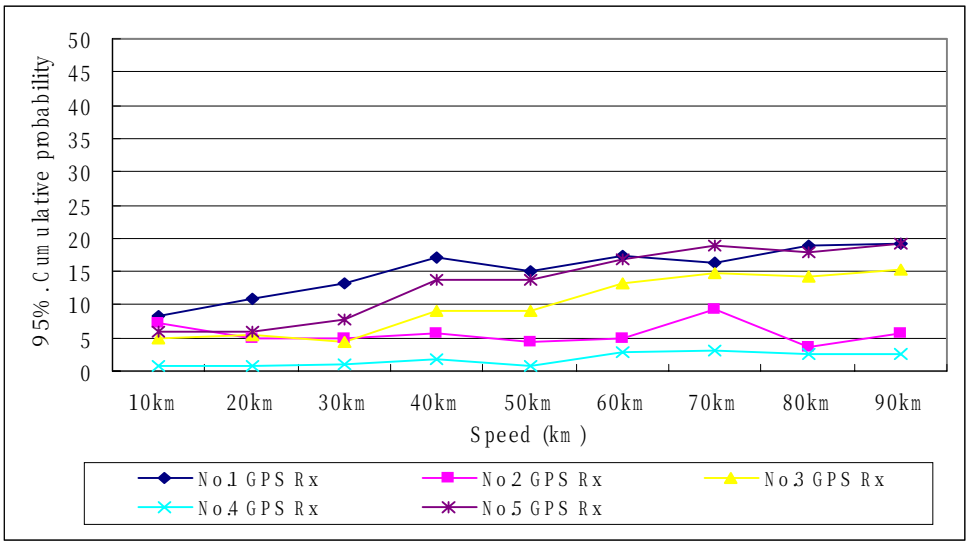
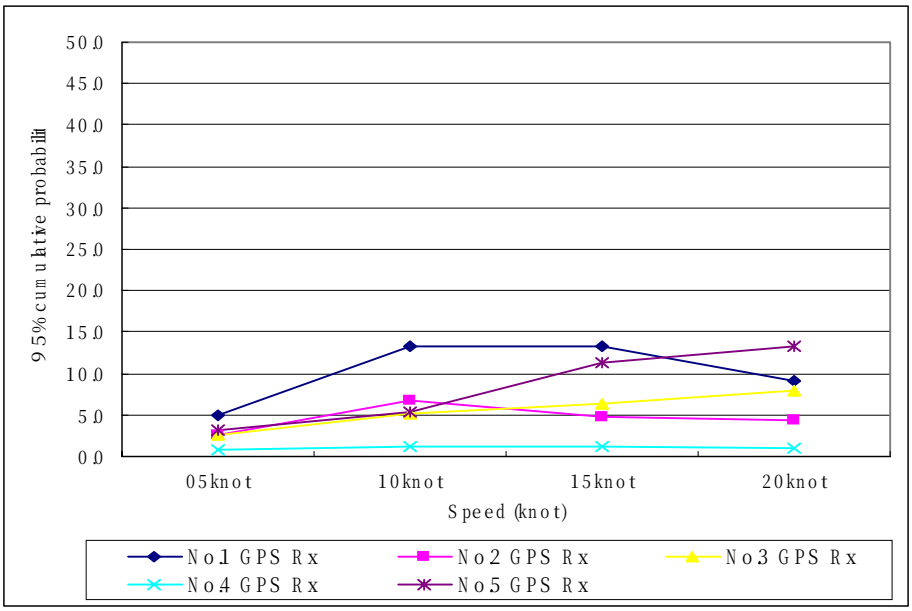


Figure 6.1.4. Error of Each GPS Receiver per Speed (Dynamic Accuracy by Ship)



GPS Receivers for navigation use of vessel are selected for measurement work as sample. In a result, dynamic error not exceed beyond 15 m until speed of 20 knot. In case the vessel speed exceeds beyond 20 knot, dynamic error of some

of sample increases in according with cursing speed and the dynamic error of remain not increases in according with cursing speed. It may be caused by harm ware of GPS receiver prepared by manufacturer.

6.1.3. Differences of Error Among Different Models of GPS Receiver

The difference of error among models was measured for five (5) model of GPS receivers. Difference of Static and Dynamic error was measured.

(1) Differences of error on static accuracy

The differences of error among different models of GPS receivers on static accuracy are summarized as shown in **Table 6.1.2.** Fluctuation of differences of error among different models of GPS receivers is shown in **Figure 6.1.5.**

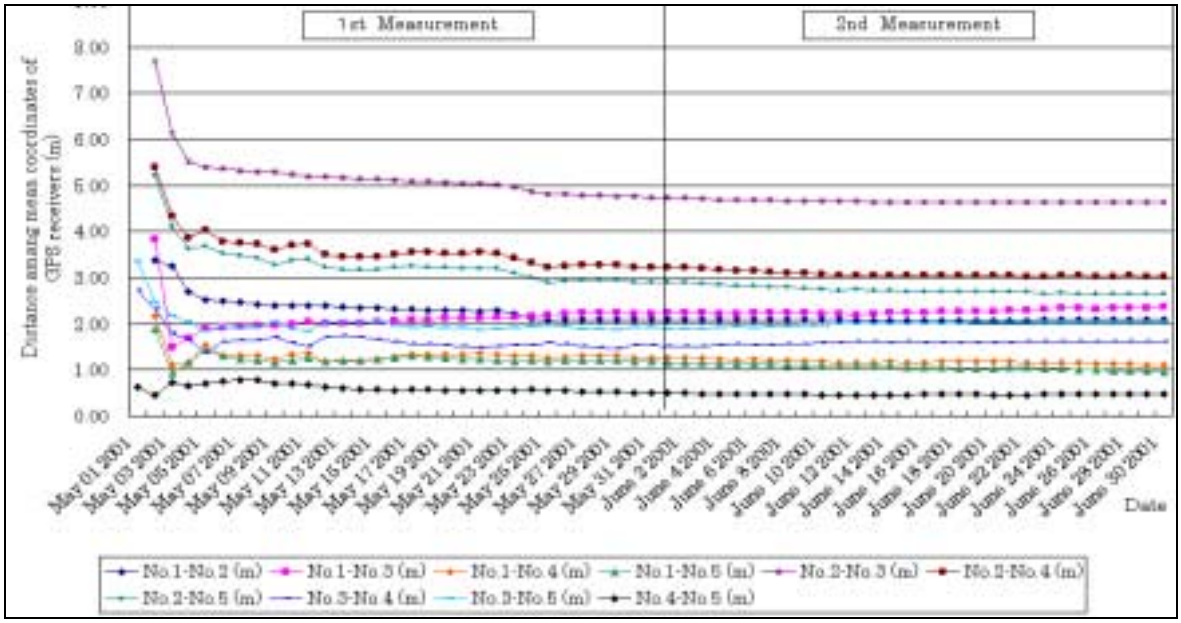
Maximum difference among five (5) receivers is 4.74m by 95% cumulative probability. It means that there is no obstacle for usual navigation of vessels. But it is required to recognize distance between ships in case the repeatability of setting of co-ordinate is required for purpose of fishery

Table 6.1.2. Differences of Static Error among Five GPS Receiver

Standards : No.1 GPS Receiver		Standards : No.2 GPS Receiver		Standards : No.3 GPS Receiver	
No.2 GPS Receiver	2.09	No.1 GPS Receiver	2.09	No.1 GPS Receiver	2.23
No.3 GPS Receiver	2.23	No.3 GPS Receiver	4.74	No.2 GPS Receiver	4.74
No.4 GPS Receiver	1.26	No.4 GPS Receiver	3.22	No.4 GPS Receiver	1.53
No.5 GPS Receiver	1.18	No.5 GPS Receiver	2.89	No.5 GPS Receiver	1.91
Standards : No.4 GPS Receiver		**Standards : No.5 GPS Receiver**			
No.1 GPS receiver	1.26	No.1 GPS receiver	1.18		
No.2 GPS Receiver	3.22	No.2 GPS Receiver	2,89		
No.3 GPS Receiver	1.53	No.3 GPS Receiver	1.91		
No.5 GPS Receiver	0.51	No.4 GPS Receiver	0.51		

: shows maximum & Minimum

Figure 6.1.5. Fluctuations of Differences of Static Error among Five GPS Receivers

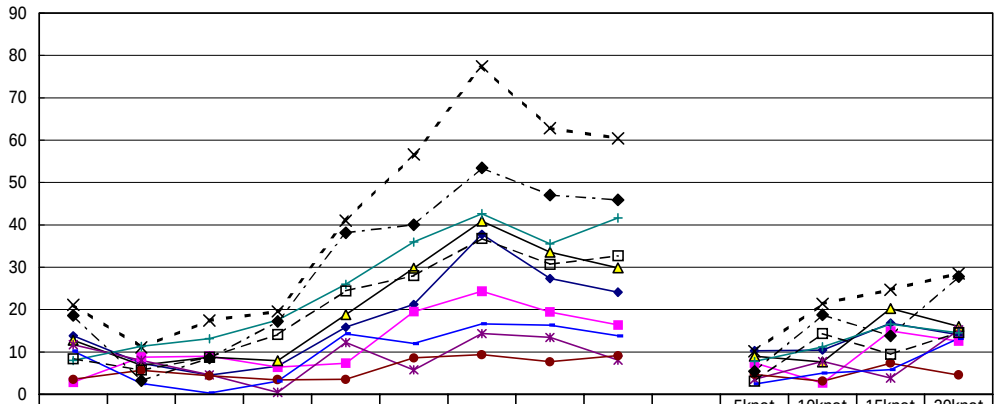


(2) Differences of error on dynamic accuracy

The differences of error among different models of GPS receivers on dynamic accuracy are summarized in **Table 6.1.3.** and those data is shown **Figure 6.1.6.**

Maximum difference among GPS Receivers is 28.53 m that is taken by 20-knot maximum speed of usual vessels. In case the cruising speed exceeding beyond 20 knot, 50m differences is observed in some combination of receivers. This may be caused by characteristics of receivers that have unique processing installed by manufacturer. This means that user should recognize these characteristics to measure position.

Figure 6.1.6. Differences of Dynamic Error among GPS Receivers



	10km	20km	30km	40km	50km	60km	70km	80km	90km		5knot (9km)	10knot (19km)	15knot (28km)	20knot (37km)
No.1-No.2 (m)	13.81	7.32	4.52	6.66	15.85	21.21	37.78	27.32	24.08		10.28	10.44	16.79	14.08
No.1-No.3 (m)	2.88	8.75	8.99	6.38	7.33	19.51	24.31	19.42	16.38		7.39	2.67	14.94	12.57
No.1-No.4 (m)	12.76	6.85	8.74	7.94	18.78	29.79	40.83	33.52	29.83		8.97	7.63	20.22	16
No.1-No.5 (m)	21.1	11.07	17.41	19.58	40.98	56.59	77.44	62.81	60.39		10.16	21.39	24.68	28.53
No.2-No.3 (m)	11.72	8.04	4.57	0.47	12.22	5.77	14.36	13.44	8.09		3.56	7.77	3.87	15.2
No.2-No.4 (m)	3.55	5.65	4.36	3.41	3.55	8.58	9.37	7.68	9.12		4.7	3.13	7.36	4.56
No.2-No.5 (m)	7.99	11.28	13.11	17.51	25.94	35.94	42.62	35.55	41.61		7.77	11.21	16.53	14.54
No.3-No.4 (m)	10.21	2.53	0.32	3.11	14.31	12	16.64	16.36	13.8		2.47	4.98	5.82	13.2
No.3-No.5 (m)	18.61	3.23	8.55	17.19	38.14	40.01	53.41	47.03	45.87		5.38	18.76	13.8	27.78
No.4-No.5 (m)	8.4	5.71	8.75	14.11	24.43	28.01	36.78	30.69	32.69		3.14	14.33	9.43	14.63

Table 6.1.3. Differences of Error among Five GPS Receivers (Dynamic Accuracy)

Standards Receiver : No.1 GPS Receiver

GPS Receiver	5knot (9km)	10km	10knot (19km)	20km	15knot (28km)	30km	20knot (37km)	40km	50km	60km	70km	80km	90km
No.2	10.28	15.81	10.44	7.32	16.79	4.52	14.08	6.66	15.85	21.21	37.78	27.32	24.08
No.3	7.39	2.88	2.67	8.75	14.94	8.99	12.57	6.38	7.33	19.51	24.31	19.42	16.38
No.4	8.97	12.76	7.63	6.85	20.22	8.74	16.00	7.94	13.78	39.79	40.83	33.52	29.83
No.5	10.16	21.10	21.39	11.07	24.68	17.41	28.53	19.58	40.98	56.59	77.44	62.81	60.39

Standards Receiver : No.2GPS Receiver

GPS Receiver	5knot (9km)	10km	10knot (19km)	20km	15knot (28km)	30km	20knot (37km)	40km	50km	60km	70km	80km	90km
No.1	10.28	15.81	10.44	7.32	16.79	4.52	14.08	6.66	15.85	21.21	37.78	27.32	24.08
No.3	3.56	11.72	7.77	8.04	3.87	4.67	15.20	0.47	12.22	5.77	14.36	13.44	8.09
No.4	4.70	3.55	3.13	5.65	7.36	4.36	4.56	3.41	3.55	8.58	9.37	7.68	9.12
No.5	7.77	7.99	11.21	11.28	16.53	13.11	14.54	17.51	35.94	35.94	42.62	35.55	41.61

Standards Receiver : No3GPS Receiver

GPS Receiver	5knot (9km)	10km	10knot (19km)	20km	15knot (28km)	30km	20knot (37km)	40km	50km	60km	70km	80km	90km
No.1	7.39	2.88	2.67	8.75	14.94	8.99	12.57	6.38	7.33	19.51	24.31	19.42	16.38
No.2	3.56	11.72	7.77	8.04	3.87	4.67	15.20	0.47	12.22	5.77	14.36	13.44	8.09
No.4	2.47	10.21	4.98	2.53	5.82	0.32	13.20	3.11	14.13	12.00	16.64	16.36	13.80
No.5	5.38	18.61	18.78	8.23	13.80	8.55	27.78	17.19	38.14	40.01	53.41	47.03	45.87

Standards Receiver : No.4GPS Receiver

GPS Receiver	5knot (9km)	10km	10knot (19km)	20km	15knot (28km)	30km	20knot (37km)	40km	50km	60km	70km	80km	90km
No.1	8.97	12.76	7.63	6.85	20.22	8.74	16.00	7.94	13.78	39.79	40.83	33.52	29.83
No.2	4.70	3.55	3.13	5.65	7.36	4.36	4.56	3.41	3.55	8.58	9.37	7.68	9.12
No.3	2.47	10.21	4.98	2.53	5.82	0.32	13.20	3.11	14.13	12.00	16.64	16.36	13.80
No.5	3.14	8.40	14.33	5.71	9.43	8.75	14.63	14.11	24.43	28.01	36.78	30.67	32.69

Standards Receiver : No.5GPS Receiver

GPS Receiver	5knot (9km)	10km	10knot (19km)	20km	15knot (28km)	30km	20knot (37km)	40km	50km	60km	70km	80km	90km
No.1	10.16	21.10	21.39	11.07	24.68	17.41	28.53	19.58	40.98	56.59	77.44	62.81	60.39
No.2	7.77	7.99	11.21	11.28	16.53	13.11	14.54	17.51	35.94	35.94	42.62	35.55	41.61
No.3	5.38	18.61	18.78	8.23	13.80	8.55	27.78	17.19	38.14	40.01	53.41	47.03	45.87
No.4	3.14	8.40	14.33	5.71	9.43	8.75	14.63	14.11	24.43	28.01	36.78	30.67	32.69

	5knot (9km)	10km	10knot (19km)	20km	15knot (28km)	30km	20knot (37km)	40km	50km	60km	70km	80km	90km
Max	10.28	21.10	21.39	11.28	24.68	17.41	28.53	14.11	40.98	56.59	77.44	62.81	60.39
Min	2.47	2.88	2.67	2.53	3.87	0.32	4.56	0.47	3.55	5.77	9.37	7.68	8.09

Legend		Minimum
		Maximum

6.1.4. Seasonal Changes of Errors

(1) Measured data in dry season

Measurement work was carried out from May 06 2001 until June 30 2001 in Jakarta according to the schedule. Measured data and Statistical calculation result is as follows:

Mean (m) = 10.5m

Standards deviation (SD) =2.1

Variance (V) = 4.4

(2) Measured data in rainy season

Measurement work was carried out from May 06 2001 until June 30 2001 in Jakarta according to the schedule. Measured data and Statistical calculation result is as follows:

Mean (m) = 9.1m

Standards deviation (SD) =2.9

Variance (V)= 8.2

(3) Analysis of seasonal error

Test result shows by 5% significance level that means there is no definite difference between dry season and rainy season.

6.2. Survey of GPS (including DGPS) needs

6.2.1. Methodology of the survey

(1) Questionnaire

This study was executed by the form of questionnaire. It was composed of 20 questions drafted by The Study Team and printed in English and Indonesian in parallel.

The contents of questionnaire are summarized as follows,

- Major specifications and situation of the ships modes of navigation, etc.,
- Users' needs for position fixing device,
- Users' needs for GPS and DGPS,
- Intention for utilizing of DGPS.

(2) Method of survey

The Local Consultant contracted with the Study Team distributed the questionnaires to ships of Indonesian nationality.

The Local Consultant visited to local offices of DGSC such as Port Administrator offices (ADPELs) and Port Offices (KANPELs) of 19 District of Navigation offices (DISNAVs) to explain the purpose of survey and content of questionnaire and asked their cooperation.

To ADPELs and KANPELs of DISNAVs Sabang, Ambon, Sorong, Jayapura and Merauke, the Local Consultant sent questionnaire by mail and explained the purposes of survey and content of questionnaire through telephone, FAX and other communication means.

6.2.2. Implementation of the survey

The Local Consultant surveyed GPS needs including DGPS under supervision of the Study Team. The members of the Study Team supported their survey at the local offices concerned of DGSC when they visited.

6.2.3. Outline of the result of survey

The distributed number of questionnaire was 5,780, and collected was 1,215, so the rate of collection was 21%. Respondents by each Type and GT(Gross Tonnage) of ship is shown in **Figure 6.2.1.** and **Figure6.2.2.**

Figure 6.2.1. Ships by GT N=1215

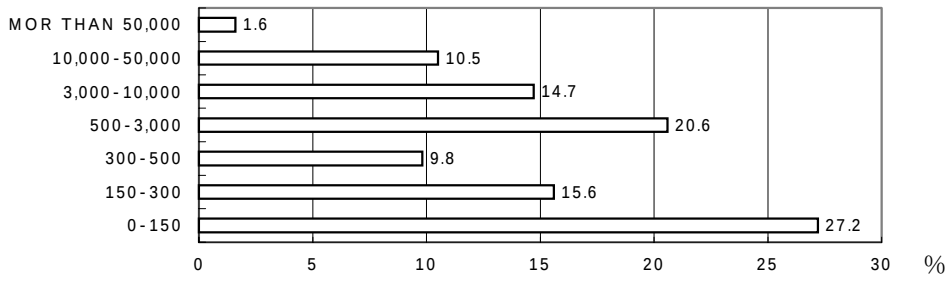
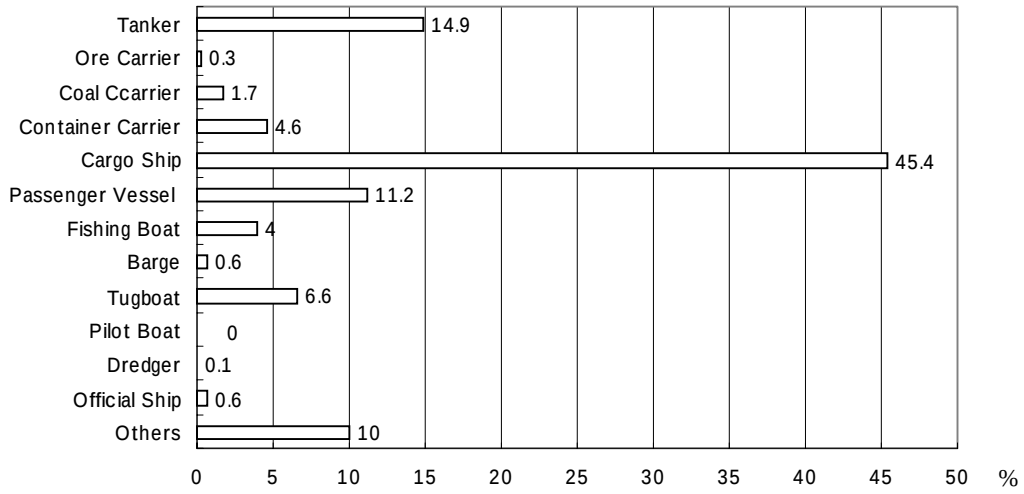


Figure6.2.2. Ships by Type



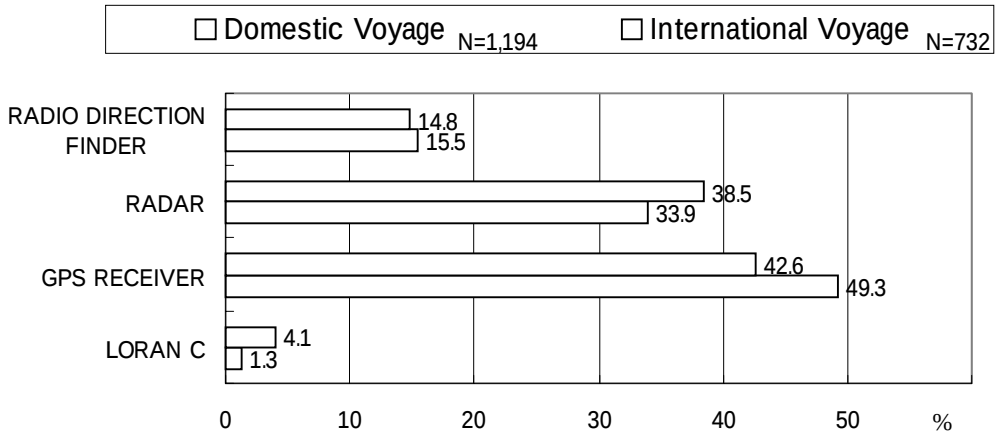
(1) Trends of users' needs for position fixing devices of ships

In order to grasp trends of users' needs for position fixing devices, we studied on boarding situation of four devices which were Radio Direction Finder, Radar, GPS Receiver and Loran C Receiver.

Both 340 of international voyage ships and 875 of domestic voyage ships were fitted with GPS receiver most. That is 42.6% of international voyage and 49.3% of domestic voyage ship.

The result is shown in **Figure 6.2.3.**

Figure 6.2.3. Electronic Nautical Apparatus on board in International and Domestic Voyage



N : Total of four devices

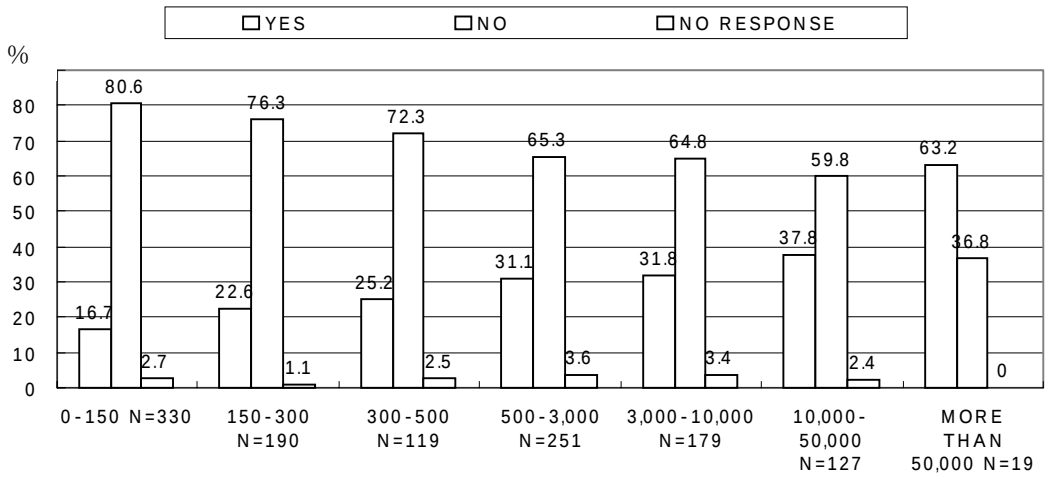
As for the ships equipped with GPS receiver by GT, the installation ratio is 100%(19) of ships " More than GT 50,000 ", 96.6%(173) of ships " GT 3,000 - 10,000 ", 91.6%(230) of ships " GT 500 - 3,000 ".

Only 26.6%(323) of total ships had experienced to use DGPS. And ratio is all 4 ships of ore carrier and 42.9%(7) of official ship, 37.5%(30) of tugboat and 33.3%(7) of coal carrrier.

And by GT, the ratio is 63.2%(12) of more than GT 50,000 and 37.8%(48) of " GT 10,000 - 50,000 " and 31.8%(57) of " GT 3,000- 10,000 ". The ratio is increased as tonnage grows.

Ships having experience to utilize DGPS by GT is shown in **Figure 6.2.4.**

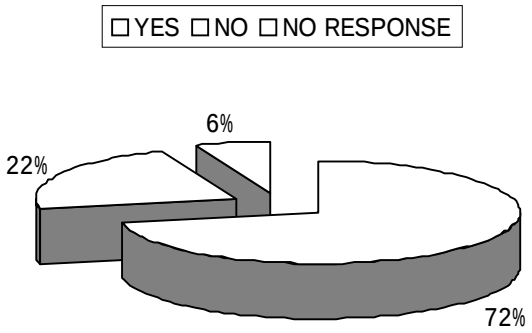
Figure 6.2.4. Ships ever Experienced to Utilize DGPS by GT



(2) Implenentation of DGPS in Indonesia

Most of the respondents (72%) have the opinion that DGPS should be implemented in Indonesia. 22% of the respondents answered not necessary, and 6 % is no answer. The result is shown in **Figure 6.2.5.**

Figure6.2.5. Opinion about the implementation of DGPS in Indonesia



By the type of ship, all of ore carrier(4 ships), barge(7ships), dredger(1ship) and official ship(7ship) answerd that DGPS should be implemented.
900 ships (74.1%) out of 1215 respondents were equipped with GPS receiver, and 323 ships (35.9%) of them had experienced to use DGPS.
305 ships, that is 94.4% of those who experienced to use DGPS, answered that DGPS should be implemented in Indonesian waters.

As for the areas where DGPS was useful, there were 523 respondent. 34.0% of respondent indicated narrow channel, 28.5 % indicated Port/Harbor area and 25.3% indicated congested area.
It is understood that the DGPS was especially useful in narrow channel.
As for the desirable accuracy for positioning, 55.4% out of 231 respondent desired the accuracy between 5 - 10 m, and 15.2% desired the accuracy between 20 - 50 m, 8.2% desired the accuracy between 10 - 20 m.

6.2.4. IALA recommendation for the handling of DGPS

In June 2001, IALA announced a recommendation for the handling of DGPS after the removal of SA. Summary is as follows.
IALA has already reaffirmed as a matter of policy the need to continue to maintain and develop DGNSS services, because IMO has required for 10m position accuracy (95%) and 10second integrity warning (of satellite malfunction; that is to say to provide users with warnings within a specified times when the system should not be used) for navigation in harbor entrances/approaches and coastal waters for SOLAS vessels.
The continuing need for DGNSS is further reinforced as it provides vital input for the proper operation of ECDIS (Electronic Chart Display Information System), ECS (Electronic Chart System) and AIS (Automatic Identification System).

6.2.5. Conclusion

(1) 305 ships, that is 94.4% of those who experienced to use DGPS, answered that DGPS should be implemented in Indonesia.
When ships fix their position, the accuracy of 5-10m is desired by the majority.
(2) The result of questionnaire was as above, it is concluded that the necessity of DGPS should be examined through the careful study on needs of mariners, integrity of the system, and international trends.

CHAPTER 7.
PROGRESS OF REGIONAL AUTONOMY

7.1. Present Status

7.1.1. Background of Regional Autonomy and Progress of Implementation

The Republic of Indonesia is an archipelagic state with local diversity and it had been governed by the centralization system for the long period. This system had suppressed to improve administration capability and had accumulated local dissatisfaction.

The Asian financial crisis, which started in 1997, had big influence on Indonesia, and the sharp fall of the currency brought social and political unrest. The reform under the Habibie Administration aimed at promotion of regional possibility.

Under the above reforms, the revision of three political-related Bills were made in January 1999 and two regulations, Local Administration Law and Financial Balance Law between Central Government and Local Government were enacted in May 1999.

It brought a big change for the old relation between Central Government and Local Government. Implementation of decentralization is an important policy to avoid national division and maintain unification as well as to promote democratization.

7.1.2. Change of Relationship between Central Government and Regional Government

The following 3 items are pointed out as main characteristics of the Local Administration Regulation No.22 in 1999, which stipulates relations between central government and regional governments:

(1) Cutting down of central government power and transferring it to regional governments.

In this regard DGSC is responsible for planning, development, operation and management of aids to navigation and maritime telecommunication. In addition to that, all district navigation officers are under DGSC control.

(2) Paralleling the relationship between regional and municipal government

(3) Checking and balancing of administration by strengthening the power of regional assembly.

7.1.3. Change of a Local-Public-Finance System

The financial transfer to the local government has so far been made by various kinds of grants and subsidies, which are budget for limited use given by the central government.

According to the Regulation for the Financial Balance between Central Government and Local Government (regulation No. 25 in 1999), the incomes from natural resources are distributed from the central government to the local government.

Although the natural resources income distribution to the local government has been expanded, the rate of distribution is different among local governments depending on the rate of natural resource productivities.

The financial transfer from the central government, as the general subsidy and the special subsidy shall attain balancing of local public finance.

7.2. Government Policy

7.2.1. Regional Autonomy Implementation Laws and Governmental Regulations

With the implementation of decentralization, relevant governmental Regulations should be established in order to specify more concrete contents of decentralization stipulated in the Local Administration Law and the Law for the Financial Balance between Central Government and Local Government.

The governmental regulation No.25 was proclaimed in June 2000 regarding to the transfer of authority, and the regulation of the authority of the government and provincial government was made.

About the local government's organization, the guideline about a local government organization mechanism was shown by the governmental regulation No.84 in 2000.

About local public finance, five related government regulations were proclaimed. Area Income and Expenditure of a prefecture and a city will be determined after the assembly's recognition by many local governments on

the contrary. The revision (regulation No.34 in 2000) of Local Tax Law, which leads big influence on the local government's self-income was made.

7.2.2. Schedule of Regional Autonomy

Local Autonomy Consulting Committee (DPOD) was set up by the Presidential Decree No.52, 2000. DPOD is going to monitor the condition of decentralization by local government and after year 2004, to adjust the number of provinces, prefectures and cities by abolition of local government that has no ability to carry out decentralization and integration of local governments in the vicinity.

7.3. Japan's Assistance

Japan is supporting mainly the local government's personnel training to improve the local government's administration capability and district development policy.

Assistance to the local governments concerning district development policy, improvement in capability and consciousness reform of the local government personnel, the secretariat personnel through the domestic training, and promotion of consciousness reform of the prefectural governors and mayors through training have been carried out.

7.4. Other Donors' Trend

7.4.1. Dautsche Gesellschaft fur Technische Zusammenarbeit (GTZ)

GTZ is carrying out the decentralization support project (SFDM) from 1994, and advising the direction of decentralization of Indonesia, mainly to the Ministry of the Interior Local Administration Department (PUMDA, past PUOD), especially about enactment of local administration law and governmental regulations.

7.4.2. Asian Development Bank (ADB)

Asian Development Bank (ADB) is carrying out Community and Local Government Support: Sector Development Program.

7.4.3. United Nations Development Program (UNDP)

UNDP is carrying out the Partnership for Governance Reform in Indonesia Project in collaboration with the World Bank and Asian Development Bank.

7.4.4. United States Agency for International Development (USAID)

USAID is supporting Regional Program for City Development in the CLEAN-URBAN Project.

7.4.5.Canada International Assistance Agency (CIDA)

CIDA has offered support for development projects. About decentralization, CIDA stations advisers for political supporting.

7.4.6.The World Bank

The World Bank is performing the policy dialog with the central government in relation to local public finance and the local government official reform. Moreover, a state health project is carried out in health field, and decentralization in health sector is supported.

CHAPTER 8.
SOCIO-ECONOMIC FRAMEWORK AND FUTURE DEMANDS

8.1. Macro-economic Framework

PROPENAS is established by GBHN and it is a new development plan replaced by REPELITA through 2000 to 2004. By PROPENAS, the short term macro-economic policy is directed at economic recovery and the medium term macro-economic policy is aimed at strengthening the base for sustainable and equitable development. Main macro-economic framework by PROPENAS is shown in **Table 8.1.1**.

Table 8.1.1. Macro Economic Framework

Indicator	1999	Projection				
		2000	2001	2002	2003	2004
Inflation rate (%)	2.0	7-9	6-8	5-7	4-6	3-5
Exchange Rate (Rp/US$)	7,809	7,000 - 8,000	7,000 - 8,000	6,500 - 7,500	6,500 - 7,500	6,500 - 7,500
Economic Growth (%)	0.3	4-5	4.5-5.5	5-6	6-7	6-7

Source; PROPENAS

8.1.1. Population

According to the Statistic Indonesia by BPS, projected population in 2004 is 222,696.7 thousands.

In the meantime, population grew by 1.59% per year during the 1990-1999 and this increasing rate decrease annually 0.04% for past 29 years. Forecasting in the target year 2007 and 2020 are estimated 231,603.1 thousands in 2007 and 263,810.6 thousands in 2020.

8.1.2. GDP

GDP Growth Rate (PROPENAS, Actual, Estimate) is shown in **Table 8.1.2**.

Forecast in 2007 and 2020 is estimated by figures of PROPENAS in Likeliest Case, +1.5 % in Optimistic Case and -1.5 % in Pessimistic Case. According to above, GDP in 2007, 2020 shall be projected in **Table 8.1.3**.

Table 8.1.2. GDP Growth Rate

Unit: %

Year	PROPENAS	Actual	Estimate		
			Likeliest Case	Optimistic Case	Pessimistic Case
2000	4.5	4.8			
2001	5		5	6.5	3.5
2002	5.5		5.5	7.0	4.0
2003	6.5		6.5	8.0	5.0
2004	6.5		6.5	8.0	5.0
2005-2007			6.5	8.0	5.0
2007-2020			6.5	8.0	5.0

Source: 1) PROPENAS

2) Indonesian Financial Statistics, April 2001

3) Statistic Year Book of Indonesia 1999

Table 8.1.3. GDP Projection

Unit : Billion Rupiah

Year	GDP		
	Likeliest Case	Optimistic Case	Pessimistic Case
2007	603,544	665,842	546,310
2020	1,368,526	1,810,840	1,030,148

8.2. Future Demands

8.2.1. Interisland Cargo Volume

Interisland cargo volume is obtained by the regression analysis of correlation between GDP and interisland cargo volume.

The projection of interisland cargo volume is shown in **Table 8.2.1.**

Table 8.2.1. The Projection of Interisland Cargo Volume

Unit：GDP ; Billion Rupiah, Cargo Volume; Thousand Ton

Year	GDP	Cargo Volume
1998	376,374.9	116,641.2
2007	603,544	277,279
2020	1,368,526	800,721

8.2.3. International Cargo Volume

International cargo volume is obtained by the regression analysis of correlation between GDP and international cargo volume.

The projection of international cargo volume is shown in **Table 8.2.2.**

Table 8.2.2. The Projection of International Cargo Volume

Unit：GDP ; Billion Rupiah, Cargo Volume; Thousand Ton

Year	GDP	Cargo Volume
1998	376,374.9.	180,839.2
2007	603,544	316,575
2020	1,368,526	761,536

8.2.4 The Number of Vessels Analysis by Formula

The future interisland calling vessel volume and international calling vessel volume are shown in **Table 8.2.3.**

Table 8.2.3. Future Interisland and International Calling Vessels Volume

Unit: vessels

	Likeliest Case			Optimistic Case			Pessimistic Case		
	Interisland	Inter-national	Total	Interisland	Inter-national	Total	Interisland	Inter-national	Total
1999	440,373	98,466	538,839	440,373	98,466	538,839	440,372	98,466	538,839
2007	826,153	143,726	969,879	968,027	159,690	1,127,717	703,483	129,164	832,646
2020	1,965,919	284,899	2,250,817	2,915,290	384,679	3,299,969	1,318,318	210,102	1,528,420

8.2.5.Route-wise Domestic Vessel

To forecast the domestic route-wise vessel volume, the gravity model methods should be applied.

8.2.6. Forecast of Marine Traffic for the Straits of Malacca and Singapore, Sea Lane I / II / III

To forecast the marine traffic for the Straits of Malacca, Singapore and Sea Lane I / II / III, regression analysis of correlation between GDP and cargo volume is applied.

Results of the calculations are shown in **Figure 8.2.1, Figure 8.2.2.**

Figure 8.2.1. Number of Traffic in Indonesia (2007)

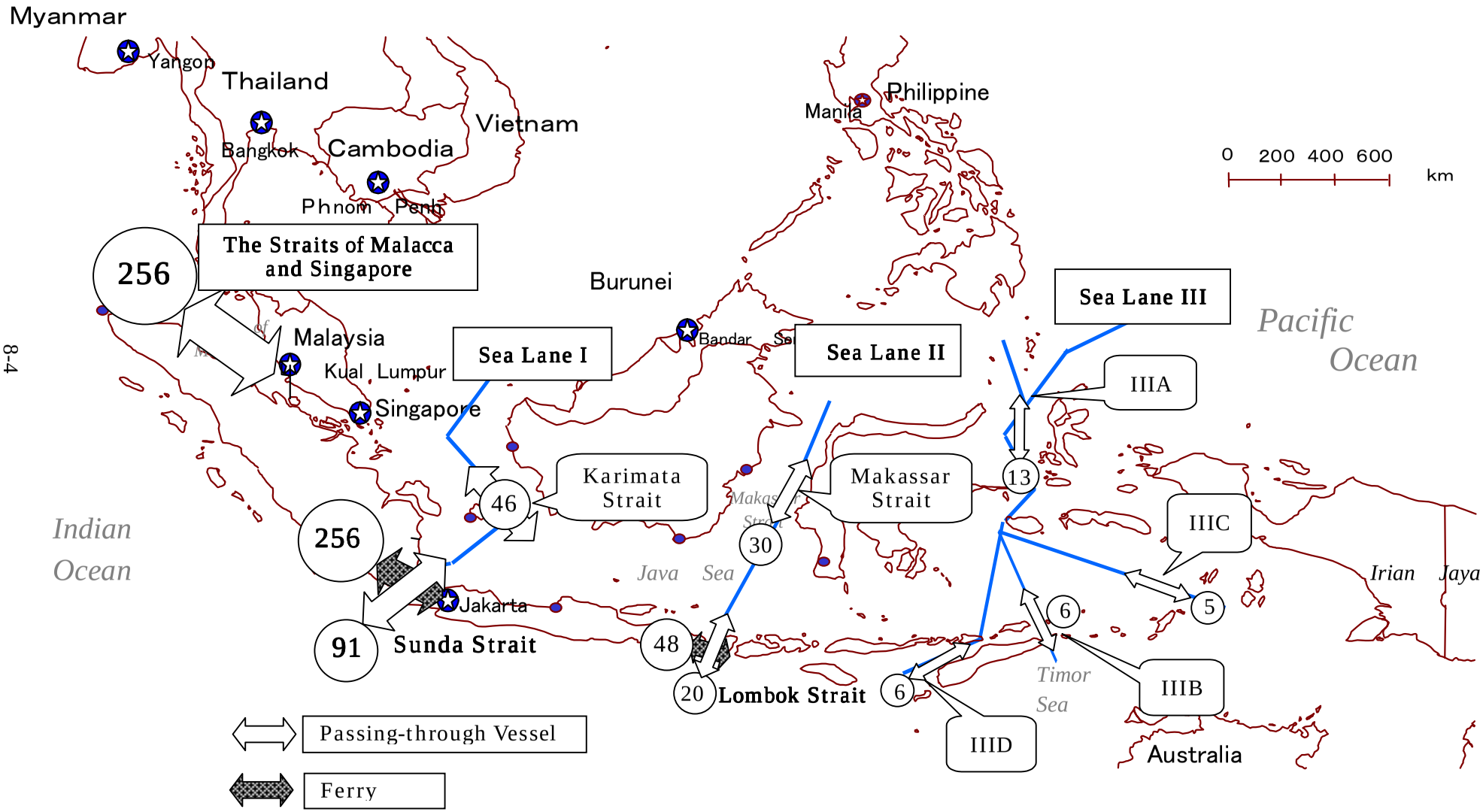
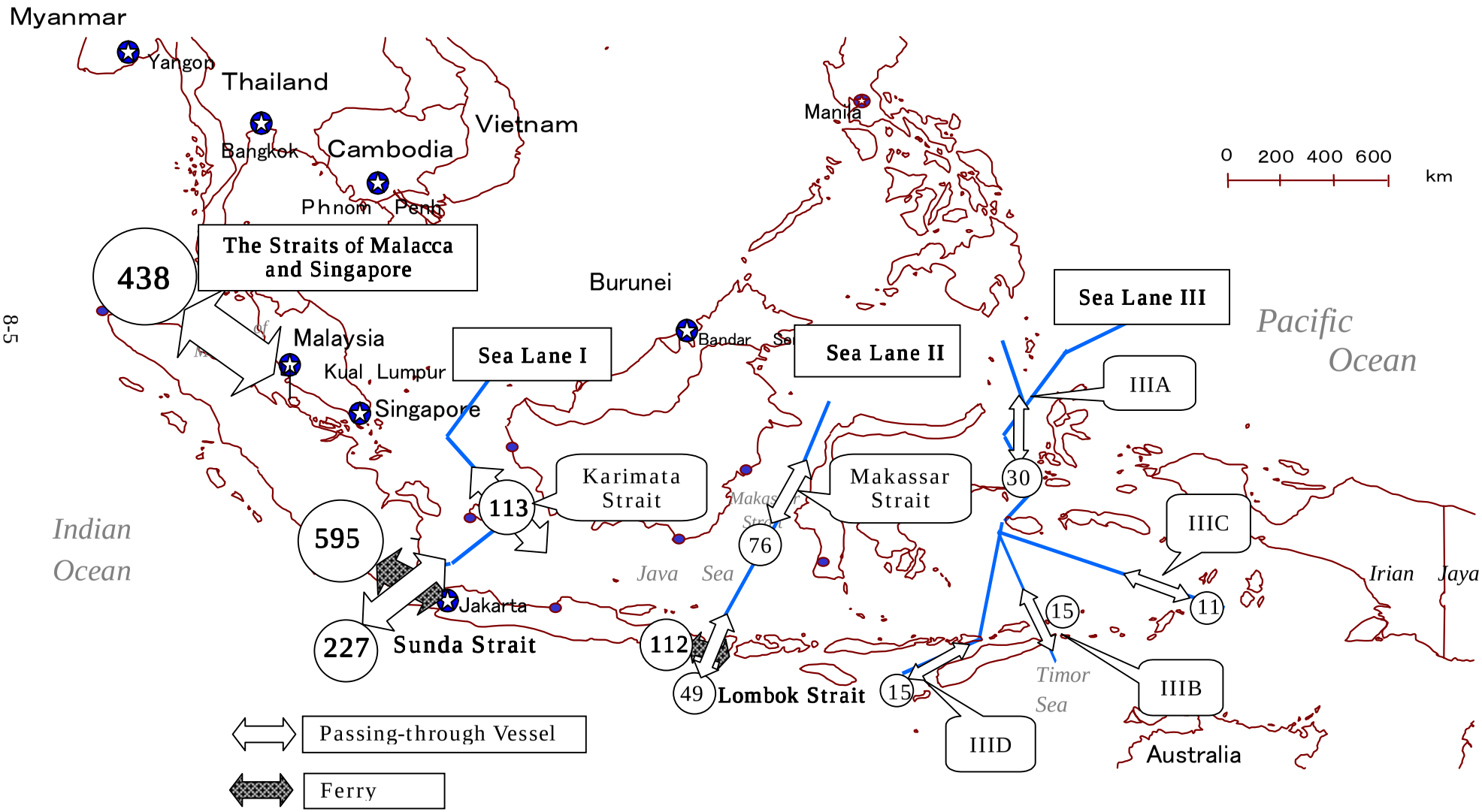


Figure 8.2.2. Number of Traffic in Indonesia (2020)



8.2.7. Passenger Volume

Forecast in 2007 and 2020 are estimated separately in domestic passenger volume under administration of DGSC and that of DGLC.

(1) Domestic passenger volume under administration of DGSC

It is estimated by regression curve between GDP and domestic passenger volume, which are shown in **Table 8.2.4.**

Table 8.2.4. Domestic Passenger Volume（DGSC）

Unit：GDP ; Billion Rupiah, Passenger ; persons

	Year	GDP	Passengers
Likeliest Case	2007	603,544	43,378,802
	2020	1,368,527	89,725,918
Optimistic Case	2007	665,842	48,934,856
	2020	1,810,840	105,571,251
Pessimistic Case	2007	546,310	37,731,017
	2020	1,030,148	73,641,806

(2) Domestic passenger volume under administration of DGLC

There is no correlation between GDP and passenger volume, therefore passenger volume change with past trend and it is estimated 0.7 % increase every year. It is shown in **Table 8.2.5.**

Table 8.2.5. Domestic Passenger Volume (DGLC)

Unit: Persons

Year	Passenger volume
2007	42,567,478
2020	46,608,061

8.2.8.Light Dues

Total light dues are forecasted according to future vessels volume. It is shown in **Table 8.2.6.**

Table 8.2.6. Light Dues

Unit: US$

Year	Likeliest Case	Optimistic case	Pessimistic case
2001	13,094,871	13,094,871	13,094,871
2007	21,011,787	23,910,529	18,437,133
2020	48,762,475	69,967,924	33,843,512

CHAPTER 9.
EVALUATION OF EXISTING MARITIME TRAFFIC SAFETY SYSTEM

9.1. Aids to Navigation System

9.1.1. Visual Aids to Navigation

(1) Visual aids to navigation of Property of Directorate General of Sea Communications (DGSC)

There are one thousand seven hundred thirty-five (1,735) units of lighted visual aids to navigation and three hundred sixty-three (363) units of unlighted visual aids to navigation operated and maintained by the District of Navigation Offices (DISNAV/ Sub DISNAV) under DGSC.

These lighted and unlighted visual aids to navigation are categorized as follows:

① Lighthouse	235 units
② Light beacon (including harbor light)	1,168 units
③ Light Buoy	332 units
Sub-total of Lighted aids	1,735 units
④ Unlighted beacon	260 units
⑤ Unlighted buoy	103 units
Sub-total of unlighted aids	363 units
Total of visual aids	2,098 units

The number of visual aids to navigation operated and maintained by each DISNAV/ Sub DISNAV is shown in **Table 9.1.1.**

(2) Visual aids to navigation of Non-property of DGSC (NON-DGSC)

There are eight hundred thirty-three (833) units of lighted visual aids to navigation and one hundred fifty (150) units of unlighted visual aids to navigation operated and maintained by the private company, state-owned company and other organizations such as State-Owned Oil Company (PERTAMINA).

These lighted and unlighted visual aids to navigation are categorized as follows:

① Light beacon	437 units
② Light buoy	396 units
Sub-total of lighted aids	833 units
③ Unlighted beacon	105 units
④ Unlighted buoy	45 units
Sub-total of un-lighted aids	150 units
Total of visual aids	983 units

The category of light beacon includes a leading light and sector light. The light beacon includes one (1) unit of RLB in the total numbers.

The number of visual aids to navigation operated and maintained as non-property aids at the operation area of each DISNAV/ Sub DISNAV is shown in **Table 9.1.1.**

Table 9.1.1. Number of Visual Aids to Navigation in Service

As of July 31, 2001

NO.	Name of DisNav	Light house	Light Beacon		Light Buoy		Unlighted beacon		Unlighted buoy		Total
			DGSC	NON-DGSC	DGSC	NON-DGSC	DGSC	NON-DGSC	DGSC	NON-DGSC	
1	Sabang	9	31	3	4	4	4	0	2	0	57
2	Belawan	5	45	15	27	27	1	1	1	0	122
3	Sibolga	7	46	5	0	0	3	3	0	4	68
4	Dumai	5	34	5	54	16	3	9	2	0	128
5	Tg.Pinang	22	71	37	26	57	60	0	11	0	284
6	Tlk.Bayaur	8	40	5	0	1	2	0	0	0	56
7	Palembang	4	63	0	16	6	8	0	4	0	101
8	Tg.Priok	27	96	81	45	38	22	0	48	0	357
9	Semarang	7	31	4	12	4	19	8	0	4	89
10	Cilacap	6	17	11	5	36	0	10	0	20	105
11	Surabaya	19	58	12	36	21	0	4	21	4	175
12	Benoa	15	57	13	8	8	12	0	1	3	117
13	Pontianak	3	42	1	14	0	6	0	2	0	68
14	Banjarmasin	7	38	49	18	14	14	2	0	0	142
15	Samarinda	5	48	137	17	134	4	16	9	10	380
16	Tarakan	2	24	0	6	10	1	0	0	0	43
17	Manado/Bitung	21	84	1	7	6	6	9	0	0	134
18	Kendari	6	62	13	0	1	6	22	0	0	110
19	Ujung Pandang	18	50	0	8	0	64	14	0	0	154
20	Kupang	13	48	10	3	0	10	2	0	0	86
21	Ambon	12	71	22	5	4	8	0	0	0	122
22	Jayapura	7	34	0	0	0	4	1	0	0	46
23	Sorong	6	52	13	17	9	3	4	0	0	104
24	Merauke	1	26	0	4	0	0	0	2	0	33
Total		235	1168	437	332	396	260	105	103	45	3081
		235	1605		728		365		148		3081
		2568					513				3081

(3) Availability of lighted visual ATN

The availability of lighted visual ATN recommended by the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) is shown as following categories;

In the absence of specific considerations for operation, the categories of availability should be:

Category 1: Availability at least 99.8%
Category 2: Availability at least 99%
Category 3: Availability at least 97%

and that the absolute minimum level of availability should be set at 95%.

The reference data for an availability of lighted visual ATN maintained by DGSC is shown in **Table 9.1.2.**

Table 9.1.2. Availability of Lighted Visual Aids to Navigation For Each DISNAV/Sub DISNAV (Reference only)

As of December 31,2000

NO.	District of Navigation	NO. of lighted ATN	Total Days unlighted										Availavility
			Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total	
1	Sabang	42	0	0	0	0	37	33	33	95	95	293	97.46%
2	Belawan	78	184	190	185	188	232	219	233	202	196	1829	91.47%
3	Sibolga	50	*	*	*	*	*	*	*	*	*	1677	87.30%
4	Dumai	91	90	91	90	62	62	60	62	60	62	639	97.45%
5	Tg.Pinang	114	0	0	0	279	279	0	0	0	0	558	98.22%
6	Tlk.Bayaur	55	76	0	0	0	124	0	0	0	0	200	98.68%
7	Palembang	84	0	0	0	0	403	0	0	0	0	403	98.26%
8	Tg.Priok	155	0	816	756	1462	1023	0	403	0	0	4460	89.54%
9	Semarang	49	30	0	159	0	162	0	0	0	0	351	97.40%
10	Cilacap	29	0	151	228	278	329	240	0	0	0	1226	84.63%
11	Surabaya	97	*	*	*	*	*	*	*	*	*	66	99.75%
12	Benoa	74	91	119	0	0	0	0	0	0	0	210	98.97%
13	Pontianak	58	-	-	-	-	-	-	-	-	-	-	**
14	Banjarmasin	64	0	0	0	463	0	0	527	0	0	990	94.38%
15	Samarinda	68	-	-	-	-	-	-	-	-	-	-	**
16	Tarakan	37	0	138	0	186	0	0	0	0	0	324	96.82%
17	Manado /Bitung	105	0	125	0	111	95	0	0	120	0	451	98.44%
18	Kendari	69	210	93	0	93	217	0	0	0	0	613	96.77%
19	Makassar	76	-	-	-	-	-	-	-	-	-	-	**
20	Kupang	71	0	0	0	0	0	90	0	0	0	90	99.54%
21	Ambon	86	-	-	-	-	-	-	-	-	-	-	**
22	Jayapura	43	0	0	0	85	56	60	0	57	0	258	97.82%
23	Sorong	73	72	62	0	0	0	0	31	90	92	347	98.27%
24	Merauke	31	0	0	180	186	186	0	0	240	0	792	90.71%

Note: * shows that data of total days unlighted was given in annual reports.
** shows no data.
Fiscal year 2000: April 1, 2000 to December 31, 2000
Availability =
(1- Total days unlighted / Number of lighted ATN x 275 days) x 100%

Source: DGSC

Table 9.1.2. shows that averaged availability of visual ATN managed by following DISNAVs are lower than 95% of IALA recommendation.

That is DISNAV Belawan, DISNAV Sibolga, DISNAV Tanjung Priok, Sub DISNAV Cilacap, DISNAV Banjarmasin and Sub DISNAV Merauke.

The following causes of failure, which reduced availability to lower than 95%, are confirmed in the site survey;

① Theft
② Collision by boat
③ Collapse
④ Sunken/drift
⑤ Shortage of spare parts
⑥ Limited budget
⑦ Lack of information

In these causes of failures above, the theft of lightning equipment, solar cell and so forth is a very serious issue that reduces the availability of visual aids to navigation.

(4) Energy source of light

Current situation of energy source used for existing lighted visual ATN is shown in **Table 9.1.3.**

The electrification ratio of energy source has increased to 93.5% from 46% at the time of Master Plan in 1985.

Table 9.1.3. Current Situation of Energy Source of Lighted Visual ATN

	Electricity	Acetylene Gas	Total
Lighthouse	235	0	235
Light Beacon	1,115	53	1,168
Light Buoy	273	59	332
Total	1,623 (93.5%)	112 (6.5%)	1,735 (100%)

Source : Result of the Study of Inventory

(5) Material of light tower

The materials of the light tower for the lighthouses and the light beacons except non-property lights are summarized in **Table 9.1.4.** and **Table 9.1.5.**, respectively.

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Table 9.1.4. Materials of Light Tower for Lighthouse

No.	Material	Quantity	Ratio	Remarks
1	Reinforced Concrete (RC)	14 units	5.9%	
2	Cast Iron	16 units	6.8%	
3	Steel Lattice	201 units	85.5%	Galvanized
4	Stone	2 units	0.9%	
5	Hybrid Tower	2 units	0.9%	RC+ Steel Lattice
Total		235 units	100%	------

Source: Inventory

Table 9.1.5. Materials of Light Tower for Light Beacon

No.	Material	Quantity	Ratio	Remarks
1	Reinforced Concrete (RC)	37 units	3.2%	
2	Steel Lattice	764 units	65.4%	Galvanized
3	Glass fiber Reinforced Plastic (GRP)	223 units	19.1%	
4	Cast Iron	4 units	0.3%	
5	Hybrid Tower	2 units	0.2%	RC+ GRP, or RC + Steel Lattice
6	Steel Pole	41 units	3.5%	
7	Stone	1 units	0.1%	
8	Wooden pole or frame	20 units	1.7%	
9	Others	76 units	6.5%	Platform, etc.
Total		1,168 units	100%	------

Source: Inventory

(6) Current situation of lighthouse

The conditions of equipment for these lighthouses are summarized in **Table 9.1.6.**

Table 9.1.6. Conditions of Equipment for Lighthouses

No.	Operation Status	Lighting Equipment	Power Supply	Light Tower	Number of Lighthouses
1	Light off	Damaged	Damaged	Collapsed	3 units
2	Light off	Good	Good	Collapsed	2 units
3	Light on	Degrading	Degrading	Degrading	13 units
4	Light on	Good	Good	Degrading	10 units
5	Light on	Degrading	Degrading	Good	7 units
Total					35 units

(7) Current situation of light beacon

The conditions of equipment for these light beacons are summarized in **Table 9.1.7.**

Table 9.1.7. Conditions of Equipment for Light Beacons

No.	Operation Status	Lighting Equipment	Power Supply	Light Tower	Number of Light Beacons
1	Light off	Damaged	Damaged	Collapsed	65 units
2	Light off	Damaged	Damaged	Degrading	47 units
3	Light off	Good	Good	Degrading	1 unit
4	Light off	Damaged	Damaged	Good	8 unit
5	Light on	Degrading	Degrading	Degrading	16 units
6	Light on	Good	Good	Degrading	50 units
7	Light on	Degrading	Degrading	Good	7 units
Total					194 units

(8) Current situation of light buoy

The conditions of equipment for light buoys of malfunction are summarized in **Table 9.1.8.**

Table 9.1.8. Conditions of Equipment for Light buoys

No.	Operation Status	Lighting Equipment	Power Supply	Buoy Body & Super Structure	Number of Light Beacons
1	Light off	Missing	Missing	Missing	18 units
2	Light off	Missing	Damaged	Damaged	3 units
3	Light off	Damaged	Damaged	Damaged	2 unit
4	Light off	Degrading	Degrading	Degrading	25 unit
5	Light off	Good	Good	Damaged	1 units
6	Light on	Good	Good	Degrading	12 units
Total					61 units

9.1.2. Radio Aids to Navigation

(1) Current situation of MFB stations

Eighteen MFB stations were established by Japan's Yen loan of 1982 fiscal year to secure navigation safety and to promote efficiency of sea traffic in the area with busy traffic in Indonesian waters.

However, most of the MFB stations stopped their operation by 1996. The major reason was that the failure of power supply system and so forth were not recovered because of weakness of management and maintenance system including a lack of budget, difficulty of access to the sites, and complex factors such as lightning attack, salty wind and rain and so forth exceeding the anticipation at the time of planning.

(2) Radar Beacon (Racon) Stations

Racon stations in Indonesia are co-sited at the major lighthouses and light beacons as landfall marks and danger marks. However, almost 80% of those racons have stopped their operation due to the malfunction.

The major cause of malfunctions is lightning attack and difficulty of procurement of spare parts and lack of technician.

(3) Differential Omega

There are five (5) differential omega stations co-sited and established in 1989 at the MFB Stations.

However, the whole omega stations in the world were closed in September 1997. Differential Omega stations should be removed from the inventory list.

9.1.3. Supporting Facilities

(1) Buoy base and workshop including associated facilities

There are nine (9) buoy bases and they carry out the maintenance work of all buoys in the whole area of Indonesia. Two (2) bases among them are not satisfactory for their work. They have no space to store buoy bodies.

All DISNAVs except Tarakan have workshops. However, the area of workshop is not sufficient for their work, and tools and equipment are too old and deficient.

Only three (3) DISNAVs have their small exclusive jetty, but ten (10) DISNAVs have no jetty. Outline of Buoy Base and Workshop is shown in **Table 9.1.9**

(2) Acetylene Gas plant

Acetylene gas plant of DGSC in Jakarta is still operating. Although the necessary gas quantity is decreasing about 3% every year, still it carries out its important duties.

(3) Procurement of spare parts

Spare parts for equipment installed in and after the middle of 1980s' are possible to procure in the domestic market. However, spare parts for old equipment installed before that time are almost impossible to procure in the market. Therefore, in some DISNAVs, staff procures substitute parts for such as lamp. This circumstance is almost the same for the radio aids to navigation equipment.

(4) Request of DISNAVs

We studied the request of each DISNAV. A lot of DISNAVs requested to build and assign vessels.

Table 9.1.9. Areas of Workshop and Buoy Base of Each District of Navigation

As of Mar. 2001

No	ATN Office	ID No	Work Shop (m^2)	Jetty (m)	Storage (m^2)	Open Storage (m^2)	Buoy Base (m^2)	Office (m^2)	Workshop Equipment	Remarks
1	SABANG	1	80	40	80	0	0	360	*	
2	BELAWAN	2	142	38	242	0	415	282	*	
3	SIBOLGA	3	80	0	80	0	0	200	*	
4	DUMAI	4	550	70	352	0	1,000	810	*	◎
5	TG.PINANG	5	230(600)	40	170	0	0	1,000	KfW	**, ****
6	TLK BAYUR	6	200	40	135	0	0	250	*	***
7	PALEMBANG	7	550	33	350	0	300	550	*	
8	TG.PRIOK	8	2,050	175	3,315	150	5,900	2,000	KfW	
9	SEMARANG	9	280	40	80	0	0	784	*	
10	CILACAP	10	160	25	0	0	300	550	*	
11	SURABAYA	11	770	115	285	165	732	2,625	*	
12	BENOA	12	80(600)	0	0	0	0	215	KfW	****
13	PONTIANAK	13	600	0	0	0	0	550	KfW	
14	BANJARMASIN	14	80	0	0	0	0	318	*	◎
15	SAMARINDA	15	1,600	50	416	200	2,956	550	*	
16	TARAKAN	16	0	0	0	0	0	750	*	
17	MANADO/BITUNG	17	600	0	80	0	750	735	IP-380	
18	KENDARI	18	600	0	0	0	0	300	IP-394	
19	UJ.PANDANG	19	400	40	177	0	0	400	IP-380	
20	KUPANG	20	200	0	0	0	0	418	IP-394	
21	AMBON	21	80(600)	40	80	0	0	844	KfW	****
22	JAYAPURA	22	426	0	55	0	0	375	*	
23	SORONG	23	600	40	120	120	750	420	IP-394	
24	MERAUKE	24	335	0	464	0	0	150	*	
25	B T K P	25	600	75	1,255	--	--	1,200	*	

** Workshop and Buoy Base of Tg.Pinang to be established to Kijang in fiscal year 2001(December).

*** Office of Tlk Bayur burnt down at Sept. 2001, will be change to Tlk Bungus.

**** Shows that workshop with 600m^2 area will be established in fiscal year 2002.

KfW Ongoing(Navigational Safety Project in Indonesia).

(5) Current situation and problem of vessels for aids to navigation services

Supporting facilities for the operation and maintenance of visual aids to navigation services are vessels, workshop and buoy base.

Vessels are used for transportation of materials to the site, for maintenance work of lighting equipment and so on.

DGSC have 75 vessels and allocated to each DISNAV/Sub DISNSAV and BTKP. These vessels are categorized to four (4) types, that is Buoy Tender, Aids Tender, Inspection Boat and Survey Vessel.

As for age of these vessels, 15 vessels are less than 15 years, 7 vessels are 16-25 years, 25 vessels are 26-35 years, 8 vessels are 36-40 years and 20 vessels are more than 40 years. It is shown in **Table 9.1.10.**

Table 9.1.10. Number of vessels for Aids to Navigation services by Age and Type

Type of Vessel	Buoy Tender	Aids Tender	Inspection Boat	Survey Vessel	Total
0-15 years		12	3		15
16-25 years	3	3		1	7
26-35 years	3	15	7		25
36-40 years		7	1		8
More than 40 years		19	1		20
Total	6	56	12	1	75

Technical condition of a vessel is indicated by condition of hull, main engine, loading capacity, cruising speed and so on.

The number of vessels of over 35 years old is 32, and occupies 42.6% of whole vessels, and technical condition of these vessels are lower than 60% in average.

Maintenance work of lighted visual aids to navigation using vessels is carried out only once or twice a year. It is not sufficient.

Vessels whose technical condition is lower than 60% occupy 48% of whole vessels, and lower than 80% occupy 77.3%. Technical condition of a vessel should be always kept higher than 80% to carry out her duty.

DGSC has a plan to scrap 29 vessels up to the year 2003, and assumes final necessary number of vessels will be 59.

9.2. Telecommunications System

Maritime telecommunication services to be provided by DGSC were defined by Indonesian Telecommunication Law No3/1989 as follows:

- Special task on search and rescue, navigation and meteorology and geophysics
- Basic telecommunication service on public communication between land and ship which is to be provided under joint operation agreement with PT. TELKOM

And as already discussed in Chapter 3, the telecommunication means should follow various international conventions and regulations.

The 221 coastal radio stations are listed at present. Available services by each classified station are as shown in **Table 9.2.1.** in principle.

Table 9.2.1. Currently Available Services by Station Class

No.	Type of Service	Descriptions	Availability by stations class			
			1st	2nd	3rd	4th
1	Directional Finding (DF)	*500kHz signal* 2,182kHz signal	✓ ✓			
2	MF TG services	*500kHz TG* 518kHz NAVTEX (4 stations) DSC/NBDP	✓ ✓ ✓	✓ ✓	✓ ✓	 (✓**)
3	MF TP services	2,182kHz Telephony	✓	✓	✓	(✓**)
4	HF TG services	DSC/NBDP	✓	✓	✓	(✓**)
5	HF TP services	Telephony.	✓	✓	✓	(✓**)
6	VHF TG services	Ch70 DSC	✓	✓	✓	(✓**)
7	VHF TP services	Ch16 Telephony	✓	✓	✓	(✓**)
8	Internal comm. (fixed) services	*Point to point telephony &* *ARQ telex.*	✓ ✓	✓ ✓	✓* ✓*	✓* ✓*

Note GMDSS consists of the above services except for those written in *Italic character*.

* : This service is available by using mobile equipment alternately.

** : Station where currently classified as 4th, but already furnishes GMDSS equipment, is required to be upgraded its classification as the 3rd.

(1) GMDSS

DGSC installed HF DSC for Sea Area A3 at 12 stations, MF DSC for Sea Area A2 and VHF DSC for Sea Area A1 at each 30 stations. However there are many blind zones in Indonesian waters. There should be covered by appropriate timing.

International NAVTEX broadcasting service is provided at Jakarta, Makassar, Ambon and Jayapura stations. While the northern part of Sumatra is covered by NAVTEXs of Singapore and Malaysia based on an agreement of NAVAREA-XI Coordination Meeting, as the results, more NAVTEX expansion or transmitter's power-up is not required.

(2) Internal Communication System

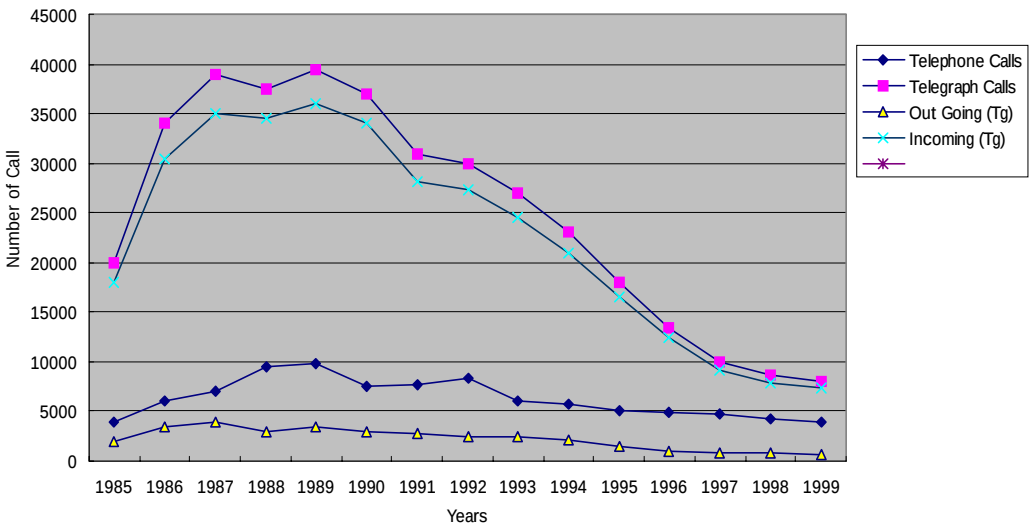
Communication system for regional offices and SAR is malfunctioned at many places due to lack of operation personnel, shortage of budget and/or reshuffling of the functions among central and local governments. While the fixed communication system between coast stations is well maintained.

For internal communication, anyway, more stable and easy to maintenance system is required. That system will be realized using state-of-the art technologies such as IT application.

(3) Public Communication System

Figure 9.2.1. shows historical traffic volumes at Jakarta station for example.

Figure 9.2.1. Traffic Volumes at Jakarta Station



The traffic, on DGSC's HF system, decreases drastically from 1990s. This phenomenon occurs due to a shift of public telegraph/telephone traffic to satellite or land mobile phone system.

Reflecting the development of telecommunication systems and the actual market's situations, the Indonesian Telecommunications Law was revised in 1999 (Law No. 36). And this public telecommunication services at offshore was opened to any operator who desires to provide the services. This means, DGSC has lost the monopolized right to provide the public services but has been released from the duty of the provision of the services too.

From the above facts, expansion or reinforcement of the facilities for public telecommunication services will not be required any more.

9.3. Search and Rescue System

9.3.1.Organization of Search and Rescue

Search and Rescue (SAR) activities in Indonesia are performed under the coordinating umbrella of the National Search and Rescue Agency（BASARNAS）.

On the other hand, DGSC is responsible for execution of SAR activities that are conducted under the coordination of BASARNAS. Furthermore, the Directorate of Guard and Rescue（GAMAT）carries out SAR tasks with its operation units.

The Directorates of Navigation and Marine Safety provide support for the GAMAT operations with the operation units of Districts of Navigation（DISNAV）and Harbor Masters（ADPEL）.
BASARNAS is also authorized to request the dispatch of units to Marine Police, Navy, Air Force in case of necessity and to coordinate all of SAR organizations during SAR operation.

9.3.2. Present Status of Search and Rescue Units

SAR Units in Indonesia are the following table.

Organization	Personnel	Local Office	Ships	Aircraft
GAMAT	(About) 3,800	Office unit 42 Fleet base 4	Patrol vessel 129	
NAVIGASI	(About) 5,300	DISNAV 24	Buoy Tender & etc. 75	
Marine and Aviation Police	(About) 5,600	Regional HQ. 27 Office unit 70 Station 150	Patrol vessel 306	Airplane 4 Helicopter 15
Navy	(About) 40,000	Fleet Command 2	Frigate etc. (About) 260	Airplane (About) 50 Helicopter (About) 40

(Source: DGSC, Marine and Aviation Police and Jane's FIGHTING SHIPS 1998-1999)

GAMAT has 129 patrol vessels because it is primarily responsible for maritime SAR activities in Indonesia. Considering the large sea area of Indonesia, the number of patrol vessels is very small.
It makes SAR activities more inefficient that GAMAT has no aircraft, which has excellent search ability compared with vessels.

In addition to the above insufficiency, patrol vessels of GAMAT are aged generally, over 70 % of the patrol vessels are over 20 years old.

To make matters worse, terrible low operation ratio resulting from a shortage of fuel and repair parts and poor maintenance has caused further insufficiency of GAMAT SAR powers. The actual ratio of operation of the patrol vessels is estimated less than 30% of the planning ratio.

9.4. Education and Training System

9.4.1. Current Situation (Maritime Telecommunication System)

(1) Current Situation of Coastal Radio Stations

① The total number of staff working for coastal radio stations is about 960. (According to Ministerial Decree 16/1999)

② As for the quality of staff, there seemed to be remarkable differences among persons as well as among stations.

③ Manuals for carrying out duties of individual stations are not provided.

④ Systematic training has not been held for years mainly due to the shortage of budget.

⑤ A silver expert has given training for maintenance to technicians at coastal radio stations since 2000.

(2) Requests on Training at Coastal Radio Stations

Requests in common are as follows:

① Establishment of systematic training in terms of organization and training staff;

② Training at manufacturers;

③ Training in Jakarta by experts including those from manufactures;

④ Training for all local technicians of coastal radio stations by visiting experts;

(3) Special Matters found during Survey

① Some technicians are excellent in their knowledge and skill and also have rich experiences. In addition they are not only creative and aggressive in carrying out their job but also are very good instructors for other staff. Even under the circumstances with shortage of spare parts, budget, etc., there are remarkable differences between a coastal radio station with such person and one without.

② There are other type of technicians who have obtained technical knowledge and skill through various kinds of training, domestic and abroad. But they do not want to disseminate the knowledge and skill to the other people. The purpose of international technical cooperation is not only to train a specific person, but also to have him disseminate the technical knowledge and skill obtained through the training to as many people as possible. They can be good instructors in OJT.

9.4.2. Current Situation (Aids to Navigation)

(1) The following information as shown in **Table 9.4.1**. and **Table 9.4.2.** is

obtained from the Report on the Preparatory Study in December 2000: (The Study Team confirmed the data at DGSC and learned that there are basically no changes as of November 7th, 2001.)

Table 9.4.1. Number of Staff engaged in Aids to Navigation as of 2000

Kind of Job	Number	Remarks
Technician	1,264	Mainly work for DGSC Headquarters and District Navigation Offices
Aids to Navigation Staff	725	Staff for operation and maintenance at aids to navigation
Vessel Crew	1,435	Those who are on board aids to navigation vessels

Table 9.4.2. Training Courses

Name of Course	Period	Remarks
Maritime Aids to Navigation, Basic Level	2 months	Once a year; mainly on operation and maintenance of visual aids to navigation
Maritime Aids to Navigation, Senior Level	2 month	Twice a year; mainly on operation and maintenance of visual aids to navigation

Note 1: Senior Level Training has not been held recently due to the shortage of budget.
Note 2: Above training is given at the facility of the Education and Training Agency.

(2) Other Information

① As there are few skilled technicians, it is said, when equipment at medium wave beacon stations and solar generated lighted buoys get in trouble, they sometimes ask staff of coastal radio stations to take care of it. It is recognized in general that they are weak in electronic field.

② There are training courses for visual aids to navigation, but no such course for radio aids to navigation and they recognize the necessity of such training.

③ Manuals specific for individual aids to navigation are not provided.

(3) Group Training by JICA

Group Training "Aids to Navigation Course" hosted by JICA has been held annually for about 30 years. Mostly every year, one person has participated in the course from Indonesia. The training period is about two months.

9.4.3. Organization for Education and Training

An integrated education and training organization in MOC is the Education and Training Agency. The Agency is responsible for education and training in

the fields of Maritime, Land, Air Communication and Meteorology.

(1) History of the Education and Training Agency

The Education and Training Agency was founded based on the Ministry of Communications Decree No. 91 in October 1980 in accordance with the Presidential Decree No.47 in 1979. It was established for the purpose of making education and training in MOC integrated and efficient system.

(2) Organization of the Education and Training Agency

The organization of the Agency is as shown in **Figure 9.4.1.**

(3) Maritime Education and Training Center

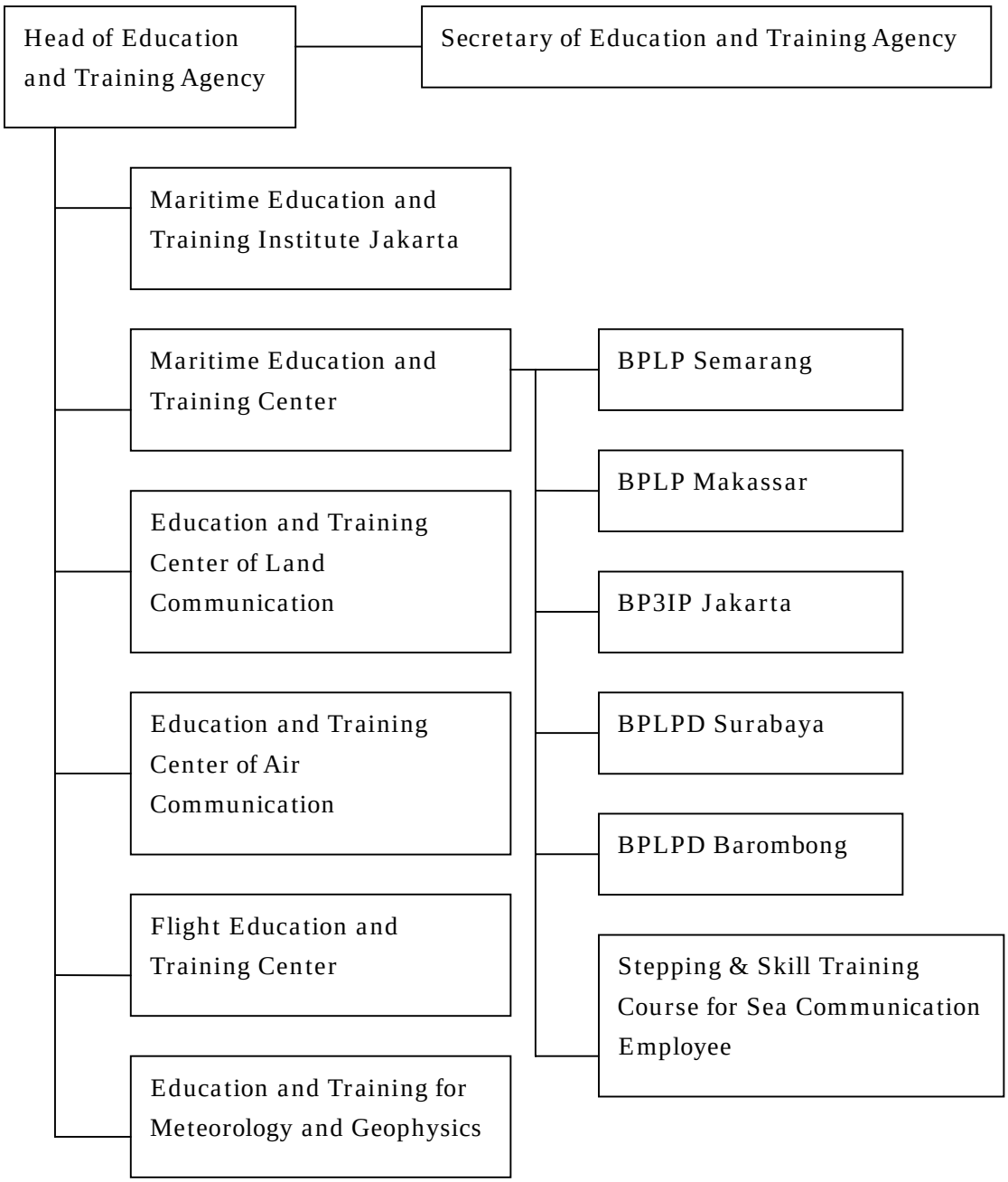
The main services under the responsibility of the Center are as follows:

① Planning education and training for seafarers;
② Making curricula and improvement of facilities and materials;
③ Guidance and supervision of national and private education and training facilities for seafarers;
④ Evaluation and coordination of seafarer's education and training.

The education and training facilities managed by the Maritime Education and Training Center are as follows:

① Maritime Education and Training Institute, Jakarta
② Merchant Marine Polytechnics; Semarang and Makassar
③ Rating and Vocational Schools; Surabaya and Barombong
④ Seafarers Education, Refreshing and Upgrading Institute, Jakarta
⑤ Stepping and Skill Training Course for Sea Communication Employee

Figure 9.4.1. Organization of Education and Training Agency



(4) Stepping and Skill Training Courses for Sea Communication Employees are as shown in **Table 9.4.3.** However, only two courses were implemented in each of the Year 2000 and 2001 for 30 persons in each course.

Table 9.4.3. Stepping and Skill Training Courses for Sea Communication Employees

Course No.	Name of Course	Records (Persons)	
		Year 2000	Year 2001
I	Education and Training for Marine Inspector Type "A"		
II	Education and Training for Marine Inspector Type "B"	30	30
III	Education and Training for Harbor Master Class "A"		
IV	Education and Training for Harbor Master Class "B"	30	
V	Education and Training for Basic Navigational Aid Equipment		30
VI	Education and Training for High-Grade Navigational Aid Equipment		
VII	Education and Training for Basic Pollution Prevention		
VIII	Education and Training for Integrated Technology of Basic Marine Transportation		
IX	Education and Training for Integrated Technology of Middle Marine Transportation		
X	Education and Training for Shipbuilding		
	Education and Training for Ship Registration		

Note: Training period for each course is two ~three months.

9.4.4. Evaluation of Current Education and Training System

(1) General

① It does not seem that there is established vision of education and training, especially in long term.

② Judging from the current situation, it will take pretty long time to train those to be engaged in proposed new international systems.

③ In connection with the above, the number of staff with good command of English is not sufficient.

④ Proper education and training will improve current poor management and maintenance situation.

⑤ On-the-job training (OJT) is very important and leaders recognize it but actually it is not given systematically.

(2) Education and Training Agency

① It is supposed that any kinds of integrated education and training system will be planned, implemented and evaluated by the Agency. However, DGSC side will examine training needs and make original concrete plans. It is necessary for planning integrated education and training system to make clear the roles of both organizations.

② The Agency is the integrated organization for the education and training of all the MOC related personnel. So far as maritime affairs concerned, however, it seems that emphasis is placed too much on seafarers' education. It is understandable from historical points of view and others but in the near future, it will be necessary to meet growing demands for the internationalization and new technologies in various fields of MOC.

(3) Maritime Telecommunication System

① The study team learned that the training given by the silver expert was very useful and popular among trainees at every coastal radio station they visited. It is desired the system will continue and stations to visit will increase in number.

② The quality of leaders give big influence on the staff and the organization. It is necessary to train not only to develop maintenance and operational knowledge and skill but also to improve attitude to carry out job.

③ The chief of every station says, "We have no problem with operation but many problems with maintenance" but it is necessary and difficult to obtain operational ability to cope with the new systems of international

nature.

④ It is necessary to make a manual specific for each station. It is useful for self-training and OJT.

(4) Aids to Navigation

① In general, they have few problems with traditional visual aids to navigation but many problems with electronic aids to navigation. To meet the requirements of proposed new systems, they have to get training in electronic field. The training must be given well in advance of the start of such facilities.

② As in the above (3)④, a specific manual for each facility should be made.

③ The Group Training for Aids to Navigation hosted by JICA has taken place for about 30 years. It is necessary to make study to meet the new requirements of new systems such as DGPS and VTS.

④ There are a lot of unknown factors in the training needs for aids to navigation. It is necessary to make more detailed study.

PART 2

MASTER PLANS AND RECOMMENDATIONS

CHAPTER 10.
MASTER PLANS UP TO YEAR 2020

10.1. Visual Aids to Navigation

10.1.1. Basic Approach

Master plan up to year 2020 is formulated in consideration of the following points and economical, technical aspects and local requirements.

- Three (3) sea lanes for Indonesia approved by the Resolution MSC.72 (69) of IMO on May 26, 1998.
- On-going project "Navigational Safety Project Indonesia" loaned by Germany
- Current situation of the existing visual aids to navigation
- Remaining location of the sites planned in Mater Plan in 1985
- Sea Traffic Routes of tankers, containers and passenger ships
- Locations and types of marine casualties
- Development plan of ports and harbors
- Rehabilitation and improvement of visual aids to navigation
- Development of visual aids to navigation
- All aids to navigation should be confirmed on appropriateness under IALA recommendation.
- Consideration of aids to navigation in Indonesian waters that Malacca strait council has installed, renewed and maintained.

The followings are applied for the formulation of the Master Plan;

(1) Types of visual aids to navigation

① Lighthouse as a fixed mark..

② Light beacon as a fixed mark including leading light, sector light and resilient light beacon.

③ Light buoy.

④ Un-lighted beacon and un-lighted buoy as day marks

(2) Height of the light tower

① Lighthouse 40m high above ground level

② Light beacon 30m, 20m and 10m high above ground level

③ Offshore light, the height is applied from the above platform level.

(3) Luminous range required for the visual aids to navigation

① Lighthouse 40m minimum 20 nautical miles

② Light beacon 30m minimum 18 nautical miles

③ Light beacon 20m minimum 15 nautical miles

④ Light beacon 10m minimum 10 nautical miles

(4) Construction materials for the light tower

The materials for the light tower is listed up as follow.

① Galvanized steel
② Reinforced concrete
③ Cast iron
④ Aluminum alloy
⑤ Glass fiber reinforced plastic (GRP)

Each materials have advantage and disadvantage respectively, depending on site condition and construction period and cost.

(5) Light source for the lighting equipment

The light source for each type of lighting equipment is proposed in this plan as shown in **Table 10.1.1**.

Table 10.1.1. Light Source of each Type of Lighting Equipment

Type	Luminous Range	Light source
Lighthouse 40m Main light Emergency light	20 nautical miles at T=0.85 (7,790cd, or over) 18 nautical miles at T=0.85(4,143cd, or over)	Metal haloid, Halogen, or Incandescent lamp Metal haloid, Halogen, or Incandescent lamp
Light beacon 30m	18 nautical miles at T=0.85 (4,143cd, or over)	Metal haloid, Halogen, or Incandescent lamp
Light beacon 20m	15 nautical miles at T=0.85 (2,500cd, or over)	Metal haloid, Halogen, or Incandescent lamp
Light beacon 10m	10 nautical miles at T=0.85 (360cd, or over)	LED type
Light buoy (Lateral, etc)	4 nautical miles at T=0.85 (21cd, or over)	LED type
Light buoy (Safe Water Mark, etc)	6 nautical miles at T=0.85 (66cd, or over)	LED type

(6) Improvement of visual aids to navigation

① Day marks
② Improvement of service range
③ Improvement of structure
④ Light monitoring system (Remote control system)

Some of aids to navigation in the straits of Malacca and Singapore have been installed and maintained by Malacca Strait council. The installation, renewal and maintenance of these aids in Indonesian waters should be reflected on this Master Plan after due consideration, if necessary.

10.1.2. Rehabilitation and Improvement of Visual Aids to Navigation

There are many aids to navigation that has been degraded, damaged or collapsed and not yet recovered to normal operation status. The facilities for visual aids to navigation are degrading yearly.

The rehabilitation and improvement of visual aids to navigation is planned based on the followings;

- Confirming actual conditions of visual aids to navigation at several sites of each District of Navigation Offices (DISNAV/ Sub DISNAV).
- Confirming the current situation of visual aids to navigation through discussion with the District of Navigation on survey.
- Result of Inventory prepared by the local consultant.
- Considering improvement of an availability and reliability of lighted visual aids to navigation.

Total number of each type of visual aids to navigation for rehabilitation and improvement is shown in **Table 10.1.2.** based on the current situation.

Table 10.1.2. Total Number of Visual Aids to Navigation for Rehabilitation and Improvement

			Total	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5
Rehabilitation and Improvement	Lighthouse		35	21	14	0	0	0
	Light Beacon	40m	1	1	0	0	0	0
		30m	10	5	4	0	1	0
		30m Offshore	1	0	0	1	0	0
		20m	56	27	11	4	12	2
		20m Offshore	10	7	0	1	2	0
		10m	85	49	22	6	4	4
		10m Offshore	68	42	8	12	4	2
		sum	231	131	45	24	23	8
	Light Buoy		61	61	0	0	0	0

(1) Lighthouses

Table 10.1.3. Rehabilitation and Improvement of Lighthouses

	No. of Rehabilitation	Lantern and Power supply	Repaired Structure	Replace - ment
Phase 1	21	16	16	5
Phase 2	14	9	8	0
Total	35	25	24	5

(2) Light beacons

The number of rehabilitation and improvement of light beacons is shown in

following **table 10.1.4.**

Table 10.1.4. Rehabilitation and Improvement of Light Beacon

	No. of Rehabilitation	Lantern and Power supply	Repaired Structure	Replace - ment
Phase 1	131	131	53	65
Phase 2	45	6	45	0
Phase 3	24(6)	13(6)	11	6(6)
Phase 4	23(23)	23(23)	0	0
Phase 5	8 (8)	8(8)	0	0
Total	231 (37)	181	109	71

Note : ( ) is shown the number of improvement

(3) Light buoys

The light buoys to be rehabilitated and improved are allocated to each District of navigation office. The total number of rehabilitation is 61 light buoys whose structures are all “No good”

In the case of light buoys, a complete buoy is supplied as condition of structure is “No Good” in column.

They are summed up to 61 light buoys by phase 1.

(4) Implementation Schedule

The implementation schedule for master plan of rehabilitation and improvement of visual aids to navigation is shown in **Table 10.1.5.**.

Table 10.1.5. Implementation Schedule of Rehabilitation and Improvement Project

Type of ATN	Phase	number of unit	Rehabilitation schedule																			
			01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
Lighthouse	Phase 1	21																				
	Phase 2	28																				
light beacon	Phase 1	131																				
	Phase 2	45																				
	Remaining	72																				
Light buoy	Phase 1	61																				

10.1.3. Development of Visual Aids to Navigation

In the Master Plan, Development plan for visual aids to navigation is decided on total number of each type, its location and project phase according to the by necessity for actual state of marine traffic and its future demand in this survey.

The total number of visual aids to navigation is assumed by the result of past investment.

All visual aids to navigation are evaluated their importance respectively and divided into five phases based on their priority. Each phase is planned to be a proper business.

(1) Estimate of amount of Master plan

In order to decide total number of visual aids to navigation for master plan, the amount of investment is estimated for visual aids to navigation in the master plan until 2020 year.

After publication of last master plan in 1985, the amount of investment for visual aids to navigation in Indonesia had been about US$142,000,000-, .

It is assumed that

① the amount for visual aids to navigation to be invested is US$180,000,000- until 2020 with adding rise of price.

② a half of the amount may be supplied for development of visual aids to navigation.

Based on the of above assumption, it is expected that total number of visual aids to navigation of 3 types will be as follows;

Lighthouse	100 units
Light beacon	360 units
Light buoy	350 units

(2) Location for development

The location for visual aids to navigation for development is selected based on the following;

- Confirming the allocations of existing visual aids to navigation
- Confirming the current situation of marine casualties by collision and grounding
- Confirming the sea lanes and traffic routes of tankers, passenger ships and so forth
- Confirming the dangerous areas on traffic routes
- Considering actual situation of ports and plans under SISTRANAS
- Considering the local requirements
- Considering the remaining locations of lighted aids to navigation planned in

the Master plan in 1985

The locations where lighthouses and light beacons are developed, should be selected as the coastal lights to be visible before the routes for approaching Indonesia or for passing through Indonesian waters, especially, sea lanes and international straits.

Total units of light buoys as the floating lighted visual aids to navigation are planned in consideration of main ports under SISTRANAS including spare buoys for emergency operation.

(3) Evaluation of visual aids to navigation for development

Lighthouses and Light beacons selected for master plan are evaluated numerically by scores of items for evaluation which are not only actual states (routes and marine causalities) but also estimated demands and policies.

Lighthouses and light beacons are given priority respectively by their total score which are summed up by each distribution of items for evaluation.

Items of evaluation and their scores are shown in **Table 10.1.6.**

However, each light buoy is not evaluated because it is installed at a specific area by District of navigation office.

Table 10.1.6. Evaluation Criteria for Lighthouse and Light beacons

Evaluation				
	Item	Score	Weigtht	Distribution
1	Land Fall	10		
	① Land fall from International route		1.000	10
	② Land fall from domestic route		0.500	5
	③ Land fall for ports and harbers		0.250	2.5
2	Turning Point	10	1.000	10
3	Dangers	10		
	① Sunken locks, Shoals, Sandbanks, Reefs, Rocks		1.000	10
	② Narrow Channels		0.500	5
	③ Tiny islands, Fishing Equipments, Marine Construction		0.250	2.5
4	Marine Casualty	10		
	① Aground, Collision		1.000	10
	② Leakage, Sunken		0.500	5
5	Marine traffic routes	10		
	① Tanker or Passenger		1.000	10
	② Container or Bulk Cargo		0.500	5
	③ Pioneer Ship, others		0.250	2.5
6	Sea- lane, The Malacca/Singapore Straits within coverage area	10		
	① Entrance or Turning point of Sea-lane		1.000	10
	② On Sea-lane (25miles on one sid)		0.500	5
	③ Near Sea lane		0.250	2.5
7	Existing Ports	5		
	① Commercial Port and DGSC Strategic Ports and Main		1.000	5
	② Commercial Port and Main Ports for Passenger ships (18 po		0.600	3
	③ Commercial Ports (68 ports)		0.400	2
	④ Non Commercial Ports (544 ports)		0.200	1
8	Ports unger SISTRANAS （111ports）	5		
	① Primary （1port）or Secondary（8 ports）		1.000	5
	② Tertiary （23 ports）Main port		0.600	3
	③ National feeder port （21ports）		0.400	2
	④ Local feeder port (58 ports）		0.200	1
9	Forecast for Traffic Demand by Province / year	5		
	① 50,000 ships, or more		1.000	5
	② 10,000 ships, or more		0.500	2.5
	③ Less than 10,000 ships		0.250	1.25

10.1.4. Total Number of Visual Aids to Navigation for Master Plan

Total number of visual aids to navigation including at rehabilitation, improvement and development up to year of 2020 is shown by each type of visual aids to navigation in **Table 10.1.7** (They did not include those by German loan.).

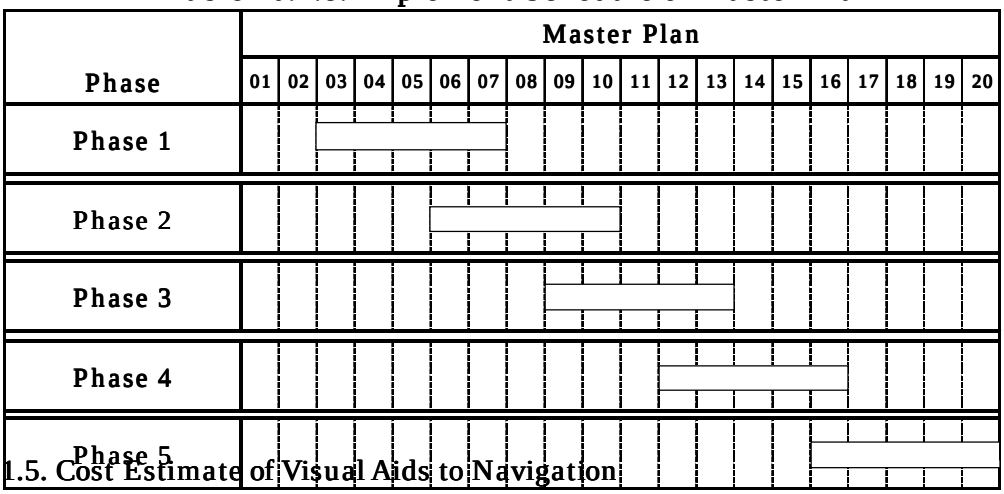
Implementation schedule of the Master Plan up to year of 2020 is divided into 5 phases. It is shown in **Table 10.1.8**.

Table 10.1.7. Total Number of Visual Aids to Navigation

			Total	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5
Development	Lighthouse		91	8	10	31	31	11
	Light Beacon	30m	42	1	0	10	16	15
		20m	89	5	6	28	27	23
		10m	55	9	5	20	17	4
		10m Offshore	136	18	17	39	37	25
		sum	322	33	28	97	97	67
	Light Buoy		350	34	91	75	75	75
Rehabilitation and Improvement	Lighthouse		35	21	14	0	0	0
	Light Beacon	40m	1	1	0	0	0	0
		30m	10	5	4	0	1	0
		30m Offshore	1	0	0	1	0	0
		20m	56	27	11	4	12	2
		20m Offshore	10	7	0	1	2	0
		10m	85	49	22	6	4	4
		10m Offshore	68	42	8	12	4	2
		sum	231	131	45	24	23	8
	Light Buoy		61	61	0	0	0	0

Note : This table does not include those by Garman loan.

Table 10.1.8. Implement Schedule of Master Plan



10.1.5. Cost Estimate of Visual Aids to Navigation

The cost required for master plan of visual aids to navigation is shown in **Table 10.1.9.**

It includes the cost of rehabilitation for visual aids to navigation.

Light dues which are imposed as beneficiary fee has been collected since 2001 year. There is a possibility to assign a part of light dues for the rehabilitation of existing visual aids to navigation.

Table 10.1.9. Total project cost for Master Plan of Visual ATN

Unit: Thousand US$

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Total
Equipemnt supply	12,955	7,902	14,787	15,214	9,591	60,449
Civil and houseing works	3,138	1,646	6,049	6,688	3,693	21,214
Instalation works	1,248	679	990	930	632	4,479
Transportation	433	266	498	513	323	2,033
Consulting Services	1,777	1,050	2,232	2,334	1,424	8,817
Sub-total	19,551	11,543	24,556	25,679	15,663	96,992
Contigency (5%)	978	577	1,227	1,284	785	4,851
Total	20,529	12,120	25,783	26,963	16,448	101,843

10.2. Radio Aids to Navigation

10.2.1. General

(1) DGPS in the world

Many of the Medium Wave Radio Beacon (MFB) stations in the world were changed to DGPS stations.

On the other hand, there are four (4) DGPS stations operated by Singapore, Malaysia and India around Malacca and Singapore Strait and Northern part of Borneo.

(2) Current situation of DGPS based on the Study in Indonesia

In the survey of GPS needs including DGPS (the Survey), the result of the survey indicated that seventy-two (72)% of the ship, which participated in the questionnaire, desired to implement DGPS.

Opinions about the desirable accuracy of positioning from a total of 231 respondents in the survey of GPS need including DGPS were also given as follows:

① 0 to 5m : 6.0% of a total respondents,
② 5 to 10m : 55.4% of a total respondents,
③ 10 to 20m : 8.2% of a total respondents,
④ 20 to 50m : 15.2% of a total respondents, and
⑤ more than 50m : 15.2% of a total respondents

On the other hand, the 10.5m with 95% probability of GPS static accuracy is derived from analysis and calculation result of data that were taken by four (4) time measurement for all GPS receivers.

10.2.2. Effectiveness of DGPS

It is expected that the introduction of DGPS system will make effectiveness as follows:

- Improvement of vessel traffic safety
- Improvement of efficiency of vessel operation (decrease of navigation cost)
- Meeting international standards as a maritime country
- Meeting new international standards and development of infrastructure
- Utilization of DGPS other than navigation

  The DGPS stations operated are utilized for the following purposes other than navigation in the world:

① Positioning for a dredging works at channel, waterway and so forth,
② Positioning for a installation or replacing of buoy
③ Positioning for a installation of a man-made gathering-place for fish,
④ Positioning for the fishing purposes, and so forth.

10.2.3. Formulation of Master Plan

For the formulation of master plan up to year of 2020 for the DGPS stations, the following points should be considered:

- Three (3) sea lanes for Indonesia approved by the Resolution MSC.72 (69) of IMO on May 26, 1998.
- Considering the Basic Design Study Report on the Project for Rehabilitation for Medium Wave Radio Beacon Stations in the Republic of Indonesia
- Considering the situation of development of DGPS stations in the neighboring countries that is Malaysia, Singapore and India.
- Considering the selection of sites that can utilize commercial power source.
- Considering the enforcement of automatic identification system (AIS) in 2002.
- Considering the master plan of VTS up to year of 2020.

The locations of DGPS stations are selected by the followings:

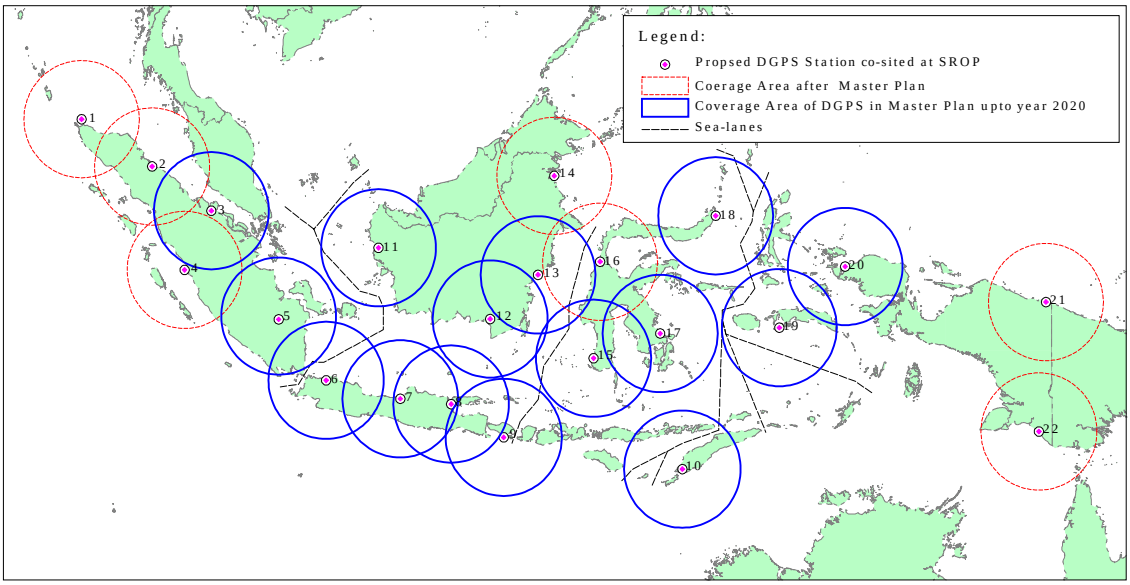
- To cover the three (3) sea lanes
- To consider the enforcement of AIS system
- To consider the marine causalities
- To consider the situation of port development
- To consider the designated traffic route

For the selection of waters to be covered by DGPS stations, two times of study were made through map survey using nautical chart and electronic map, that is the First Study and Second Study.

At the first study, the whole Indonesian waters were covered by 31 circles with the radius of 300km, as far as possible. Every center of these circles was put on the position of coastal radio stations. Twenty-two (22) stations were remained after the second study. The coastal radio station for this purpose is in conformity with Class I, Class II or Class III of coastal radio stations.

After that, finally fifteen (15) waters to be covered by DGPS station are selected by using criteria.
As a result of study above, fifteen (15) DGPS stations are proposed for the Master Plan up to year 2020. Coverage area by these DGPS stations is shown in **Figure 10.2.1.**

Figure 10.2.1. Proposed DGPS Station in Master Plan



Locations of fifteen (15) DGPS stations proposed in the Master Plan up to year 2020 are shown in **Table 10.2.1**. In this Table, number of the proposed DGPS stations is complied with number given in **Figure 10.2.1.**

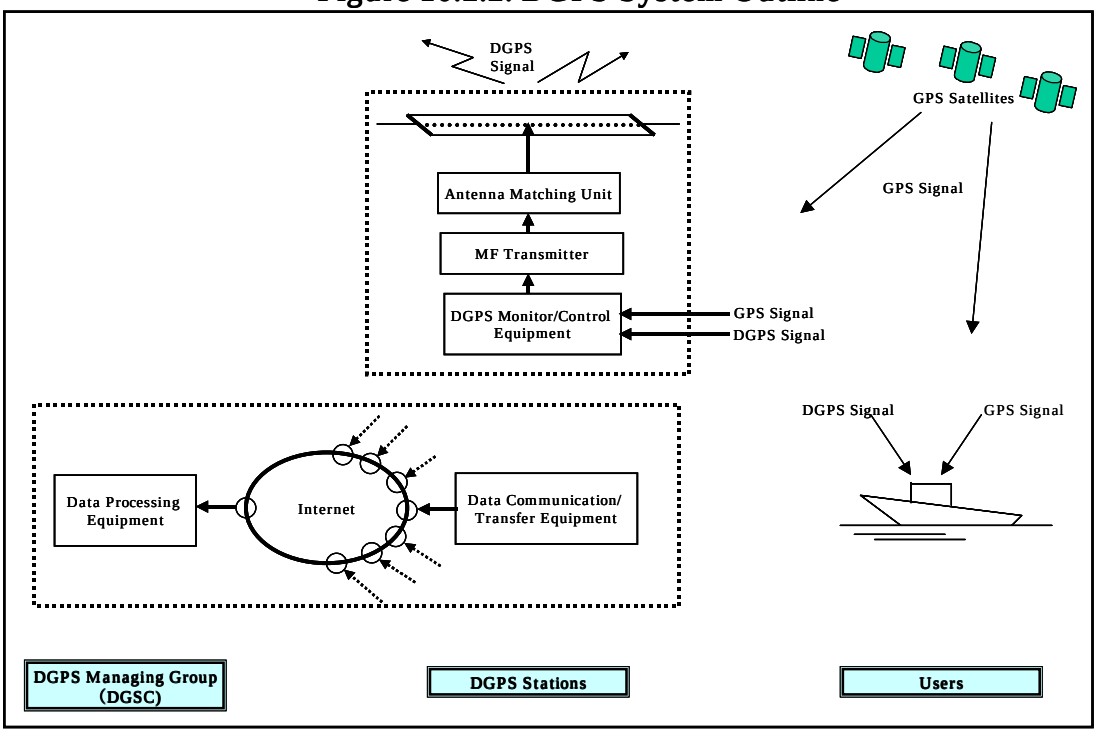
Table 10.2.1. Location of Proposed DGPD Stations in Indonesia up to Year 2020

NO	NAME	CLASS	LATITUDE	LONGUITUDE	PROVINCE
3	Dumai	I	01-41-10N	101-27-20E	Riau
5	Palembang	I	02-58-08S	104-46-44E	Sumatera Selatan
6	Jakarta	I	06-07-08S	106-51-47E	DKI Jakarta
7	Semarang	II	06-58-34S	110-20-35E	Jawa Tengah
8	Surabaya	I	07-13-05S	112-44-08E	Jawa Timur
9	Benoa	III	08-44-35S	115-12-32E	Bali
10	Kupang	II	10-12-49S	123-37-05E	Nusa Tengagra Timur
11	Pontianak	III	00-01-16S	109-19-02E	Kalimantan Barat
12	Banjarmasin	II	03-18-09S	114-34-38E	Kalimantan Selatan
13	Balikpapan	II	01-16-02S	116-49-32E	Kalimantan Timur
15	Makassar	I	05-06-22S	119-26-31E	Sulawesi Selatan
17	Kendari	III	03-58-00S	122-34-20E	Sulawesi Tenggara
18	Bitung	I	01-27-03N	125-11-03E	Sulawesi Utara
19	Ambon	I	03-41-57S	128-10-40E	Maluku
20	Sorong	II	00-53-03S	131-16-29E	Irian Jaya

10.2.4. DGPS System Outline

The DGPS system is composed mainly of "DGPS transmitting system" and "DGPS monitoring system" as shown in **Figure 10.2.2.**

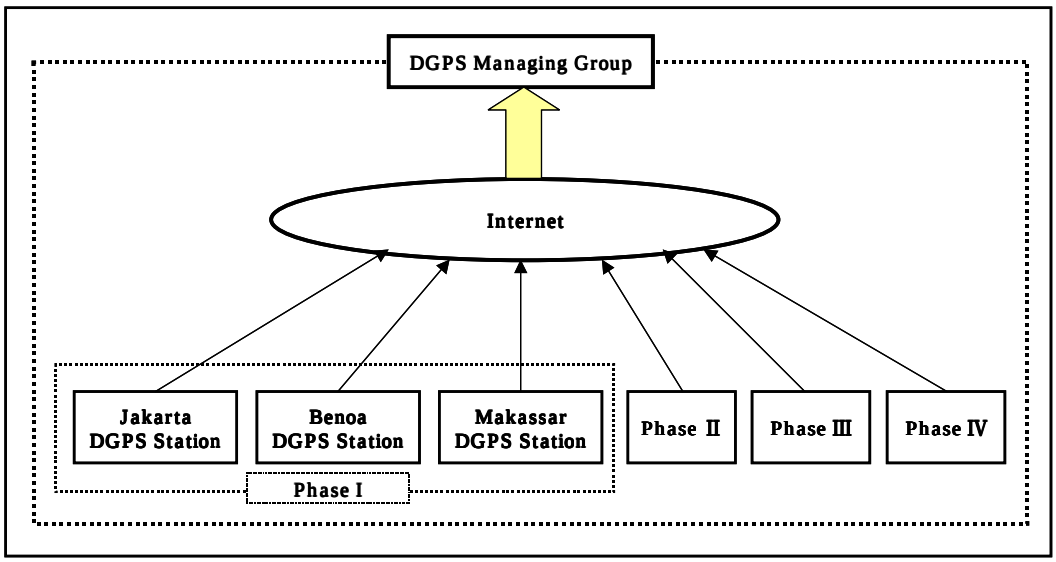
Figure 10.2.2. DGPS System Outline



10.2.5. Operation, Maintenance and Management System Plan

For the operation and maintenance system, DGPS Operation and Maintenance System was planned as shown in **Figure 10.2.3.**

Figure 10.2.3. DGPS Operation and Maintenance System Plan



10.2.6. Implementation Schedule

The implementation schedule of DGPS station up to year of 2020 is shown in **Table 10.2.2.**

Table 10.2.2. Implementation Schedule of DGPS Stations in Indonesia

Site No.	Site Name	Year														
		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
01	Jakarta															
02	Semarang															
03	Benoa															
04	Makassar															
05	Banjarmasin															
06	Balikpapan															
07	Pontianak															
08	Dumai															
09	Palembang															
10	Surabaya															
11	Kupang															
12	Kendari															
13	Ambon															
14	Sorong															
15	Bitung															

10.2.7. Cost Estimate

The cost estimate is applied for the project cost and operation and maintenance cost as shown in **Table 10.2.3.**

The cost estimate is divided into Local Currency and Foreign Currency phase by phase.

Table 10.2.3. Cost Estimate of DGPS

Unit: Thousand US$

Phase / Description	I	II	III	IV	Total
1. Procurement Cost	3,879	5,545	5,880	6,243	21,547
2. Installation and setup	404	579	635	842	2,460
3. Spare Parts	465	665	735	936	2,801
4. Civil and Housing Works	59	68	72	78	276
5. Training	92	120	127	130	469
6. Ocean Transportion	78	113	117	127	435
7. Consultant Fee	402	572	764	845	2,583
8. Sub-total	5,379	7,661	8,330	9,202	30,571
9. Contingency (5%)	269	383	416	460	1,529
Total	5,648	8,044	8,746	9,662	32,100

10.2.8. Radar Beacon (Racon) Stations

The development and improvement of the Racon stations in the Master Plan was planned as follows

All Racon stations should be co-sited or annexed to the lighthouse or light beacons, where power supply is certainly utilized. The installation method should be planned in consideration of lightening attack because there are many existing Racon damaged by the lightning attack.

The Study Team confirmed that seventy-six (76) % of the existing Racon stations are damaged through the site survey and the survey of inventory in the Study.

Considering the malfunctions and damages by lightning attack and so forth, rehabilitation and improvement of Racon stations are planned to be implemented after completion of improvement and rehabilitation of lighthouses and light beacons.

The rehabilitation and improvement plan was made for the following Racon stations:

① Rehabilitation criteria of Racon station

- Racon which indicates a existence of dangers, atolls etc.
- Racon installed near the veering point
- Racon installed at shore 10-30 nautical miles from axis line of sea-lane Landfall Mark
- Racon installed around DGSC strategic ports
- Racon installed around main ports under SYSTRANAS
- Improper topographical condition to marine radar

② Number of RACON Stations to be rehabilitated and improved

- 25 units of Racon Stations mainly as danger marks for sea-lanes
- 25 units of Racon stations mainly as landfall marks for major ports and main ports under SYSTRANAS

Total fifty (50) units of Racon stations are proposed for the rehabilitation and improvement project.

Implementation schedule of the Racon stations are shown in **Table 10.2.4.**

Table 10.2.4. Implementation Schedule of RACON Stations

Phase	Year												
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Phase I													
Phase II													

The cost estimate of RACON Stations is divided into each work category by phase is shown in **Table 10.2.5**.

Table 10.2.5. Cost Estimate of RACON Stations

Unit: Thousand US$

Description	Phase I	Phase II	Total
1. Procurement Cost	2,190	2,110	4,300
2. Installation Cost	185	179	364
3. Spare Parts	229	205	434
4. Civil & Housing Works	7	6	13
5. Training	99	95	194
6. Ocean Transportation	27	26	53
7. Consultant Fee	193	185	378
8. Sub-total	2,930	2,806	5,736
9. Contingency	146	140	286
Total	3,076	2,946	6,022

10.3. Supporting facilities for Aids to Navigation

10.3.1. Vessels

(1) Present condition

Vessels for aids to navigation services in Indonesia is categorized as four types, that is Buoy Tender, Aids Tender, Inspection Boat and Survey Vessel. At present, the number of each type of vessels belonging to DGSC are 6 Buoy tenders, 56 Aids tenders, 12 Inspection boats and 1 Survey vessel, that is 75 vessels in total, and assigned to 24 DISNAVs/Sub DISNAVs and BTKP. Number of vessels by type and class is summarized in Table 10.3.1.

Table 10.3.1. Number of Vessels by Type and Class

As of July 31, 2001

DISNAV	No	Type of Vessel / Class	Survey Vessel	Buoy Tender	Aids Tender (incl. Supply Vessel)				Inspection Boat			Total
			I	I	I	II	III	IV	II	III	IV	
DISNAV Class I	4	Dumai		1			3			1		5
	5	Tg. Pinang		1	1		2			1		5
	8	Tg. Priok			2		2	2				6
	11	Surabaya		1	1		2			1		5
	15	Samarinda		1			2			1		4
	17	Bitung			1		2					3
	19	Makassar			1		2					3
	21	Ambon			1							1
	23	Sorong		1	1			1	1			4
		Sub Total		5	8		15	3	1	4		36
					26				5			
DISNAV Class II	2	Belawan			1		2					3
	6	Tlk. Bayur			1							1
	7	Palembang					4			1		5
	9	Semarang					4					4
	12	Benoa			1	1						2
	14	Banjarmasin				1	1			2		4
	16	Tarakan				1	1					2
	20	Kupang			1		1					2
	22	Jayapura			1	1					1	3
		Sub Total			5	4	13			3	1	26
					22				4			
Sub DISNAV	1	Sabang			1		1					2
	3	Sibolga			1							1
	10	Cilacap					2					2
	13	Pontianak				1				1		2
	18	Kendari				1						1
	24	Merauke			1					1	1	3
		Sub Total			3	2	3			2	1	11
					8				3			
BTKP	25	BTKP	1	1								2
Total			1	6	16	6	31	3	1	9	2	75
					56				12			

(2) Proposed Scrapping Plan

The proposed scrapping plan is shown in the Table 10.3.2.

Table 10.3.2. Five-years Scrapping Plan in Master Plan

No.	Type	Class	Number of Vessels at 2001	Number to be scrapped up to year of:						Balance
				2002	2005	2010	2015	2020	Total	
1	Survey Vessel	I	1						0	1
2	Buoy Tender	I	6					2	2	4
3	Aids Tender	I	16	1					1	15
		II	6	2	1	2	1		6	0
		III	31		8	10	1	7	26	5
		IV	3		1		1	1	3	0
Sub-total of 3			56	3	10	12	3	8	36	20
4	Inspection Boat	II	1		1				1	0
		III	9			1	4	1	6	3
		IV	2				1	1	2	0
Sub-total			12	0	1	1	5	2	9	3
Total			75	3	11	13	8	12	47	28
Balance			75	72	61	48	40	28	28	

(3) Rehabilitation Plan of Vessels

The rehabilitation plan of vessels for aids to navigation services up to year of 2020 is shown in Table 10.3.3.

Table 10.3.3. Rehabilitation Plan up to Year of 2020

No.	Type	Class	Number to be rehabilitated up to year of:					
			2002	2005	2010	2015	2020	Total
1	Survey Vessel	I				1		1
2	Buoy Tender	I		4	2			6
3	Aids Tender	I		3				3
		II			1			1
		III		7	6			13
		IV		2				2
Sub-total of 3			0	12	7	0	0	19
4	Inspection Boat	II						0
		III		3	2			5
		IV		1	1			2
Sub-total			0	4	3	0	0	7
Total			0	20	12	1	0	33

(4) Development plan up to year of 2020

The vessels to be required and developed for aids to navigation services up to year of 2020 are summarized in Table 10.3.4.

Table 10.3.4. Vessels to be developed up to Year 2020

Type of Vessel	As of 2001	Scrapping Plan up to Year 2020	Number to be required at 2020	Number to be developed
Buoy Tender	6	2	9	5
Aids Tender	56	36	29	9
Inspection Boat	12	9	24	21
Survey Vessel	1	0	1	0
Total	75	47	63	35

(5) Implementation Schedule for Rehabilitation and development Plan

The implementation schedule for rehabilitation and development of vessels up to year of 2020 is shown in Table 10.3.5.

Table 10.3.5. Implementation Schedule for Rehabilitation & Development of Vessels for Aids to Navigation

	Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Sub-total	Total
Rehabilitation	1 Survey Vessel														1 vessels					1	33
	2 Buoy Tender						4 vessels													6	
											2 vessels										
	3 Aids Tender																			19	
	(1) Class I						3 vessels														
	(2) Class II										1 vessel										
	(3) Class III						7 vessels														
											6 vessels										
	(4) Class IV						2 vessel														
	4 Inspection Boat																			7	
	(1) Class III						3 vessels														
											2 vessels										
	(2) Class IV						1 vessels														
											1 vessel										
Development	1 Buoy Tender						3 vessels													5	35
															1 vessel						
													1 vessel								
	2 Aids Tender						4 vessels													9	
											2 vessels										
															1 vessel						
													2 vessels								
	3 Inspection Boat										10 vessels									21	
															6 vessels						
													5 vessels								

(6) Cost Estimation for Rehabilitation and Development of Vessels

The cost estimation for rehabilitation and development of vessels for aids to navigation services is shown in Table 10.3.6.

Table 10.3.6. Estimated Project Cost of Vessels

Unit: Thousand US$

No.	Item	Pahse I	Pahse II	Pahse III	Pahse IV	Total
1	Rehabilitation					
	(1) Survey Vessel			1,200		1,200
	(2) Buoy Tender	3,000	1,972			4,972
	(3) Aids Tender	4,140	2,642	0	0	6,782
	(4) Inspection Boat	840	828	0	0	1,668
	(5) Consulting Fee	159	108	24	0	291
	Sub-total of 1	8,139	5,550	1,224	0	14,913
2	Development					
	(1) Buoy Tender	29,076	0	12,291	13,571	54,938
	(2) Aids Tender	21,080	11,636	6,424	14,184	53,324
	(3) Inspection Boat	0	21,530	15,720	15,935	53,185
	(4) Consulting Fee	1,504	994	1,033	1,310	4,841
	Sub-total of 2	51,660	34,160	35,468	45,000	166,288
3	Total of 1. & 2.	59,799	39,710	36,692	45,000	181,201
4	Contingency	2,989	1,985	1,834	2,250	9,058
	Grand Total	62,788	41,695	38,526	47,250	190,259

10.3.2. Buoy Base and Workshop

(1) Buoy base

1) Buoy bases to be improved

The following DISNAVs/SubDISNAVs have enough space for buoy base and open storage at present. But one of them is submerged under the water at high tide, and other one is little bit smaller considering the increase of buoys in future. Therefore, they must be improved.

1)-1 Buoy bases

① DISNAV Belawan (Class II) (Enlargement)
② DISNAV Dumai (Class I) (Enlargement)
③ DISNAV Palembang (Class II) (Enlargement)
④ DISNAV Tg. Priok (Class I) (Rising ground level(GL))
⑤ Sub DISNAV Cilacap (Class II) (Enlargement)
⑥ DISNAV Surabaya (Class I) (Enlargement)
⑦ DISNAV Samarinda (Class I) (Enlargement)
⑧ DISNAV Bitung (Class II) (Enlargement)
⑨ DISNAV Sorong (Class I) (Enlargement)

1)-2 Open storage

① DISNAV Tg. Priok (Class I) (Enlargement and rising GL)
② DISNAV Surabaya (Class I) (Enlargement)
③ DISNAV Sorong (Class I) (Enlargement)

2) Buoy bases to be developed

The following DISNAVs/SubDISNAVs have no space for buoy base nor open storage for mooring materials. Buoy base and open storage must be

developed at following offices:

2)-1 Buoy base

① Sub DISNAV Sabang (Class II)
② Sub DISNAV Sibolga (Class II)
③ DISNAV Tg. Pinang (Class I)
④ DISNAV Tlk. Bayur (Class II)
⑤ DISNAV Semarang (Class II)
⑥ DISNAV Benoa (Class II)
⑦ Sub DISNAV Pontianak (Class II)
⑧ DISNAV Banjarmasin (Class II)
⑨ DISNAV Tarakan (Class II)
⑩ Sub DISNAV Kendari (Class II)
⑪ DISNAV Makassar (Class I)
⑫ DISNAV Kupang (Class II)
⑬ DISNAV Ambon (Class I)
⑭ DISNAV Jayapura (Class II)
⑮ DISNAV Merauke (Class II)

2)-2 Open storage

① Sub DISNAV Sabang (Class II)
② DISNAV Belawan (Class II)
③ Sub DISNAV Sibolga (Class II)
④ DISNAV Dumai (Class I)
⑤ DISNAV Tg. Pinang (Class I)
⑥ DISNAV Tlk. Bayur (Class II)
⑦ DISNAV Palembang (Class II)
⑧ DISNAV Semarang (Class II)
⑨ Sub DISNAV Cilacap (Class II)
⑩ DISNAV Benoa (Class II)
⑪ Sub DISNAV Pontianak (Class II)
⑫ DISNAV Banjarmasin (Class II)
⑬ DISNAV Tarakan (Class II)
⑭ DISNAV Bitung (Class I)
⑮ Sub DISNAV Kendari (Class II)
⑯ DISNAV Makassar (Class I)
⑰ DISNAV Kupang (Class II)
⑱ DISNAV Ambon (Class II)
⑲ DISNAV Jayapura (Class II)
⑳ Sub DISNAV Merauke (Class II)

(2) Workshop, and its storage

1) Workshop and Storage

The workshops including workshop equipment and storage of following offices should be improved up to the year of 2020:

①	Sub DISNAV Sabang	(Class II)
②	DISNAV Belawan	(Class II)
③	Sub DISNAV Sibolga	(Class II)
④	DISNAV Dumai	(Class I)
⑤	DISNAV Tlk. Bayur	(Class II)
⑥	DISNAV Palembang	(Class II)
⑦	DISNAV Semarang	(Class II)
⑧	Sub DISNAV Cilacap	(Class II)
⑨	DISNAV Surabaya	(Class I)
⑩	DISNAV Banjarmasin	(Class II)
⑪	DISNAV Samarinda	(Class I)
⑫	DISNAV Tarakan	(Class II)
⑬	DISNAV Jayapura	(Class II)
⑭	Sub DISNAV Merauke	(Class II)
⑮	BTKP	(BTKP)

2) Storage

Storage house should be developed to following offices up to the year of 2020:

①	DISNAV Tg. Pinang	(Class I)
②	DISNAV Benoa	(Class II)
③	Sub DISNAV Kendari	(Class II)
④	DISNAV Ambon	(Class I)

(3) Jetty

There are ten (10) DISNAVs, which have no exclusive jetty, and some of owned jetties are not in satisfactory condition.

1) Jetty to be developed

①	Sub DISNAV Sibolga	(Class II)
②	DISNAV Tlk Bayur	(Class II)
③	DISNAV Benoa	(Class II)
④	Sub DISNAV Pontianak	(Class II)
⑤	DISNAV Banjarmasin	(Class II)
⑥	DISNAV Tarakan	(Class II)
⑦	DISNAV Bitung	(Class I)
⑧	Sub DISNAV Kendari	(Class II)
⑨	DISNAV Kupang	(Class II)

⑩ Sub DISNAV Merauke (Class II)

2) Jetty to be improved

① DISNAV Dumai (Class I)

② DISNAV Palembang (Class II)

③ Sub DISNAV Cilacap (Class II)

④ DISNAV Samarinda (Class I)

Further study must be required for jetty prior to commencement of the project.

(4) Implementation schedule and cost estimation for buoy base and workshop

Implementation schedule for workshops and buoy bases etc. are shown in Table 10.3.7.

Table 10.3.7. Implementation Schedule for Supporting Facilities (Buoy Bases and Workshops)

	Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Development	Buoy Base (15)	3																		
					3															
								4												
											2									
															3					
	Open Storage (20)	5																		
					5															
								4												
											3									
															3					
	Storage (4)	2																		
					2															
	Jetty (10)				1															
								3												
											3									
															3					
Improvement	Buoy Base (9)	2																		
					2															
								2												
											2									
															1					
	Open Storage (3)				2															
								1												
	Workshop (15)	3																		
					4															
								2												
											3									
															3					
	Jetty (4)	2																		
					2															

(5) Estimated project cost

The estimated project cost for development and improvement of workshops and buoy bases except jetty is shown in Table 10.3.8.

Table 10.3.8. Estimated cost of for the development and improvement of workshop and buoy base

Unit: Thousand US$

Phase	I	II	III	IV	V	Total
A. Equipment supply	3,331	4,006	2,721	2,942	2,721	15,721
B. Civil and housing works	278	378	193	267	208	1,324
C. Installation works	221	284	224	234	243	1,206
D. Transportation	89	95	64	68	62	378
Consulting Fee	212	279	186	245	224	1,146
Total	4,131	5,042	3,388	3,756	3,458	19,775
Fiscal Contingency	207	252	170	188	173	990
Grand Total	4,338	5,294	3,558	3,944	3,631	20,765

10.4. VTS System

10.4.1. General

The Master Plan for VTS System is required to formulate for Malacca/Singapore Strait, Sea Lane I, II and III for surveillance of vessels navigating sea-lanes and relative sea area. To formulate VTS System in the Master Plan, the following item and report should be sufficiently considered.

- Existing TSS and ship reporting system for Malacca and Singapore Strait.
- Feasibility Study Report of VTMS for Sea Lane I and II issued by French Consultant Group.
- German Loan Project.

10.4.2. Review of Present Status

(1) General

Three (3) sea-lanes are designated in Indonesian waters as follows:

Sea Lane I : Sunda Strait, Java Sea, Kalimata Strait heading to South China Sea,

Sea Lane II : Lombok Strait, Makassar Strait, heading to Celebes Sea,

Sea Lane III: Indian Ocean, Arafura sea, Banda sea, Maluku sea heading to Pacific Ocean and Celebes sea.

Malacca/Singapore Straits:

This strait is one of sea area to be studied by Study Team. However VTMS has been formulated upon agreement among Indonesia, Malaysia and Singapore and it is known as STRAITREP. As of December 2001, STRAITREP has been in service. Ship navigating report is now sent to Indonesia from Singapore by E-mail.

As a result of this, we focused our study to Sea Lane I, Sea Lane II and Sea Lane III, and Access to Dumai and Surabaya.

(2) Review of Present circumstance.

To select the project site for VTS System, the following aspects were considered.

- Strategic aspect.
- Navigational hazards.
- Environmental condition.
- Traffic density and patterns.
- Relation with Existing VTMS for Malacca / Singapore Straits.

10.4.3. Proposed Sites for Master Plan

(1) General

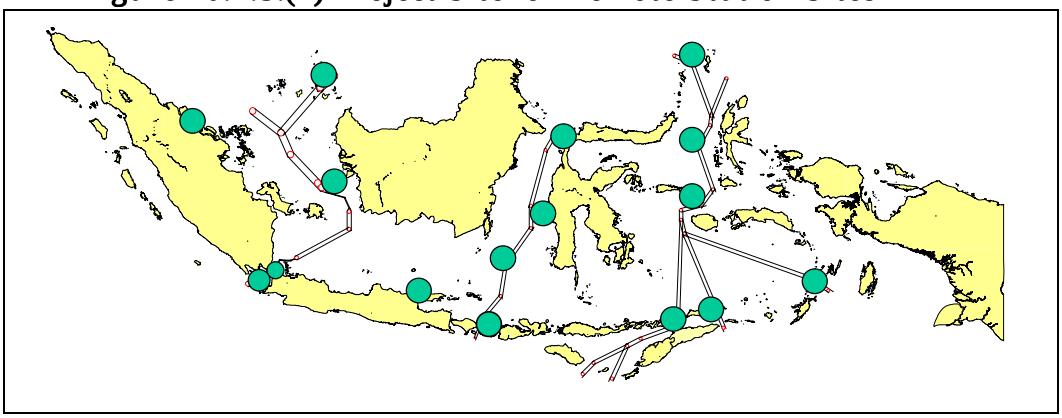
VTS System is composed of Remote station site for measuring of vessel navigating information and Sub/Man Center for processing measured

information. To formulate VTS System, we must decide project sites for Remote station sites and Main/Sub Center sites.

(2) Project sites for Remote station

French Plan is adopted basically for Master Plan by year 2020. In addition, six (6) VTS sites are proposed for Sea Lane III and two (2) VTS System for Access route areas to Dumai and Surabaya port based on review of present status. Allocation plan of remote site is shown in **Figure 10.4.3. (1).**

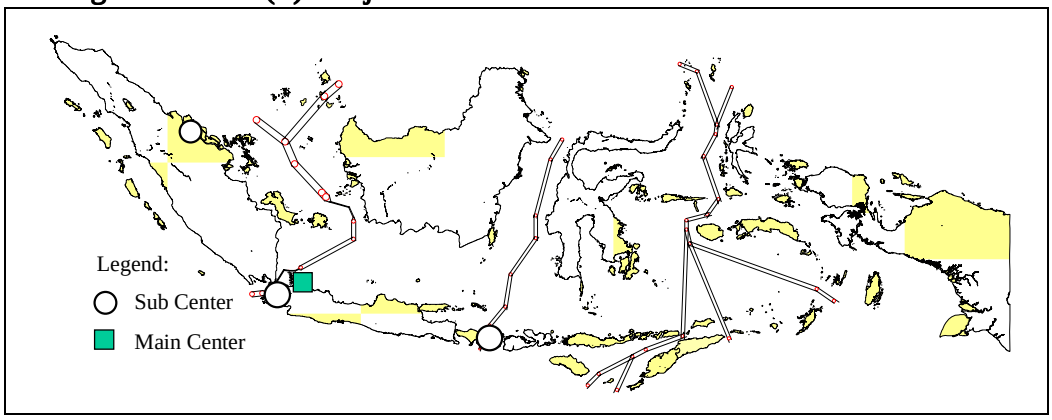
Figure 10.4.3.(1) Project Site for Remote Station Sites



(3) Proposed site for Main and Sub Center

All radar data and AIS information are sent to Jakarta Center and Sub Center through satellite communication link and micro radio link for management of vessels navigating inside sea-lanes. Allocation plan of Main and Sub Center sites are shown **Figure 10.4.3. (2).**

Figure 10.4.3.(2) Project Site for Main and Sub Center



10.4.4. Service Area of Radar /AIS

Service area of Radar /AIS is limited within line of sight distance. Line of sight distance is determined by installation height of the station. Therefore, the station installation height is very important. **Table 10.4.4** shows the service area (Range) that is calculated under the condition of the target ship's antenna height=5m. Altitude of Remote station site is taken by map survey. To ensure the designed range, the 100m high antenna tower is adopted for Remote station sites in Pulau Kalukalukuang and Pulau Molu.

Table 10.4.4. Service Area of Radar/AIS Stations

Site ID	Site Name	Province	Altitude (m)	Tower Height (m)	Antenna Height (m)	Range (NM)
01	Dumai Access	Riau	3	25	28	17
02	Surabaya Access	Java Timur	2	20	22	16
11	Tanjung Lesung	Java Barat	130	35	165	34
12	Merak	Java Barat	134	20	154	33
13	Pulau Sarutu	West Kalimantan	425	35	460	53
14	Pulau Natuna	North West Kalimantan	600	20	620	61
21	Tanglad	Nusa Penida	433	20	453	53
22	Pulau Kalukalukuang	South Sulawesi	10	100	110	32
23	Buttu Tuopoang	South Sulawesi	385	35	420	51
24	Buttu Salome	Central Sulawesi	310	35	345	47
31	Pulau Alor	Nusa Tenggara	550	20	570	59
32	Pulau Romang	Maluku	500	20	520	56
33	Pulau Molu	Maluku	125	100	225	43
34	Pulau Sulabes	Maluku Utara	600	20	620	61
35	Pulau Mayu	Maluku Utara	400	20	420	51
36	Pulau Maru	Sulawesi Utara	300	20	320	45

In Radar System, target detection level is also dependent on the target size. For example, maximum target detection range is 25.4NM. This range distance is calculated by radar equation for the target that has radar cross-section of 25 m^2.

10.4.5. System Design

(1) General

VTS System is comprised of remote site and Main/Sub Center. Remote site observes position of vessel and others, so that those information is processed to manage sea-lane and related sea area.

(2) System configuration of VTS System

To attain objectives, we prepare two (2) types of configuration of VTS System, one is Plan-A and the other is Plan-B. Plan-A adopts the combined system of radar and AIS as sensor at remote station sites and four (4) AIS remote station sites where few vessels are navigating. Plan-B adopts AIS as sensor at twelve (12) remote station sites except the area (Sunda and Lombok Strait area) where vessels are congested. System configuration of Plan-A and Plan-B are shown in **Figure 10.4.5.(1)** and in **Figure 10.4.5.(2)** respectively.

Figure 10.4.5.(1) System Configuration of Plan-A

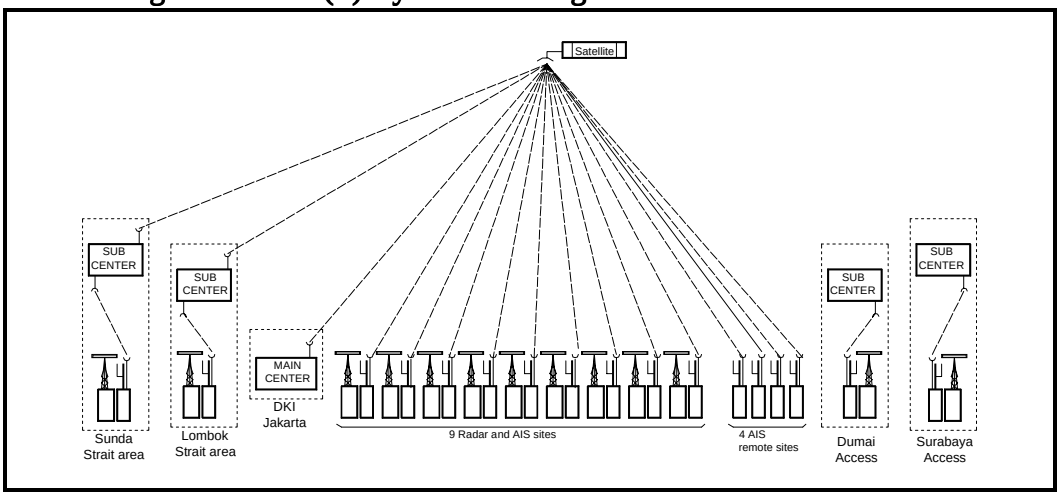
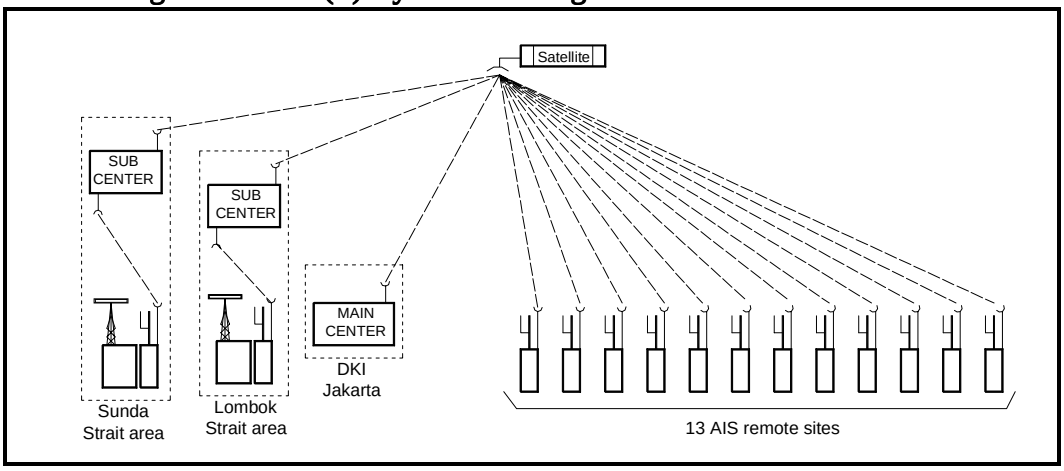


Figure 10.4.5.(2) System Configuration of Plan-B



(3) Comparison of Plan-A and Plan-B

We prepare the comparison list to clarify characteristics of AIS that is adopted as sensor of VTS System.

Detailed specification of AIS is not yet concreted as of December 2001. Detailed specification will be settled in near future because installation of AIS for SOLAS ship will be forced on July 2002. Plan-B expects advantage of lower investment than Plan-A.

VTS System for Access to Dumai and Surabaya are eliminated from Plan-B because it is suitable to install Port VTS in those areas.

Basic concept of Plan-B is as follows:

① For the most useful part of the sea lane areas, AIS stations should be installed to grasp the surrounding vessel's position data.
② For the most congested area, one radar and AIS station (combined system) should be installed in order to monitor the vessels as many as possible.

10.4.6. Selection of Mater Plan from Plans

We review present circumstance of sea-lanes and other conditions. We believe this proposed system (Plan-B) is not entirely perfect system but this is the most efficient and useful solution to monitor the huge sea lane and its subordinate area. We recommend here to formulate Plan-B as the reasonable system for Sea Lane I, II and III.

10.4.7. Equipment Specification

(1) Radar System

The Radar System is installed at radar site. Two types of radar is needed to attain objectives of this project. One is sea-lane type radar for small target detection that is required to have high resolution. Other is precise discrimination type radar that is used to monitor narrow area. The X-Band Radar with large size antenna is fitted for Long Range Radar. Detailed specification of equipment installed at radar site is as follows;

① Radar Antenna
② Radar Transmitter- Receiver
③ PPI Monitor

④ Radar Signal Preprocessor
⑤ Radar Terminal Controller

(2) VHF Radio system

The VHF radio transceiver is installed and used to communicate with vessels.

(3) AIS

The AIS is used to receive vessel position data including other relative navigation information automatically. The received information is sent automatically to Sub Center and Main Center.

(4) Sub Center System

Sub center is comprised of equipment as follows;

① Operator Console
② Terminal Controller
③ Radar data Processor
④ AIS data terminal
⑤ Satellite modem for Center
⑥ VHF Controller

(5) Main Center System

Main center is comprised of equipment as follows;

① Operator Console
② Terminal Controller
③ Satellite communication modem for Sub-Center and AIS remote station.

(6) Software

- OS of UNIX or WINDOWS (WINDOWS-NT4.0 or higher) is adopted as operating system.
- C language is adopted as application source language.

(7) Communication network for VTS System.

- Main Center and remote sites/Sub Center are connected by Satellite link to transfer information among remote sites, Sub Center and Main Center. Those functions will be prepared by VSAT communication system or equivalent system

(8) Micro radio link

- The Micro radio link is used for communication between radar site and Sub center. Frequency band should be 7.5GHz band.

10.4.8. Civil Works

(1) General

The radar and AIS project site (station site) should be located on the top of mountain or high position because radar and AIS shall cover wide sea area. This is meaning to require the civil works to install equipment at project site. The civil works are comprised of leveling of site, construction of equipment house, construction of tower foundation and erection of tower. The access road to site and landing pier are required for some project site to forward the equipment and construction materials.

(2) Radar and AIS sites

The proposed positions for radar station was selected by map survey.
Map and hydrographic chart were studied deeply to find the suitable position in Pulau Kalukalukuang and we finally decided present position even though altitude of position is 10m high because of no suitable high position.

(3) Leveling of project site and Equipment house

① In case Radar and AIS are equipped:

Equipment house and radar antenna tower are mainly constructed to install equipment. One house is needed for site keepers for daily maintenance and guard of equipment. Leveling works for project site are required approx. 1200m^2. The house and tower are surrounded by fence.

② In case only AIS is equipped:

Equipment house and antenna pole are mainly constructed to install equipment. Leveling of project site is approx. 900m$^{2.}$ The premise is surrounded by high fence.

(4) Access Road and Landing piers

Access road is constructed for forwarding materials. Landing pier is constructed to forward materials including equipment at isolated island where there is little population. Those are useful to access for maintenance of equipment.

(5) Tower and Site layout

Tower is constructed at remote site and sub center to install radar, AIS and parabolic antenna. Materials of radar tower should be strong enough to support those antennas. Two (2) types of site layout are prepared to allocate equipment house, tower and relative construction. One is the AIS base station model and the other is radar and AIS site model.

10.4.9. Operation and Maintenance (O/M)

(1) Organization of Operation and Maintenance

Two kinds of Operation groups are provided to operate and maintain the VTS system on the 24-hour basis. One is for Main Center group and the other is for Sub Center group.

① Main Center group

Main Center group for Sea Lane I, II and III composes of thirty-two (32) personnel who are required for this works. This group has three (3) maintenance personnel who are in charge of daily maintenance for Main Center in Jakarta. Detailed Organization is shown in **Figure 10.4.9.(1)**.

Summarized personnel for Main Center group is as follows :

- Center chief: 1 person
- Deputy: 1 person
- Maintenance Technician: 3 persons
- Supervisor and Operators: as shown in **Table 10.4.9.(1)**:

Table 10.4.9.(1) Supervisor and Operators for Main Center

	Nos. of console	Staffs for one group	Nos. of shift	Backup Staffs	Total Staffs
Supervisor	1	1	3	1	7
Operator	6	3	3	2	20

② Sub Center group

One group for Sub Center composes of twenty (20) personnel who are required for this works. This group has three (3) maintenance personnel who are in charge of daily maintenance at Sub Center. Detailed Organization is shown in **Figure 10.4.9.(2)**.

Summarized personnel for Operation and Maintenance group is as follows:

- Center chief: 1 person
- Deputy: 1 person
- Maintenance Technician: 3 persons
- Supervisor and Operators: as shown in **Table 10.4.9.(2)**:

Table 10.4.9.(2) Supervisor and Operators for Sub Center

	Nos. of console	Staffs for one group	Nos. of shift	Backup Staffs	Total Staffs
Supervisor	1	1	3	1	7
Operator	1	1	3	2	8

Figure 10.4.9.(1) Organization of O/M of VTS System for Main Center

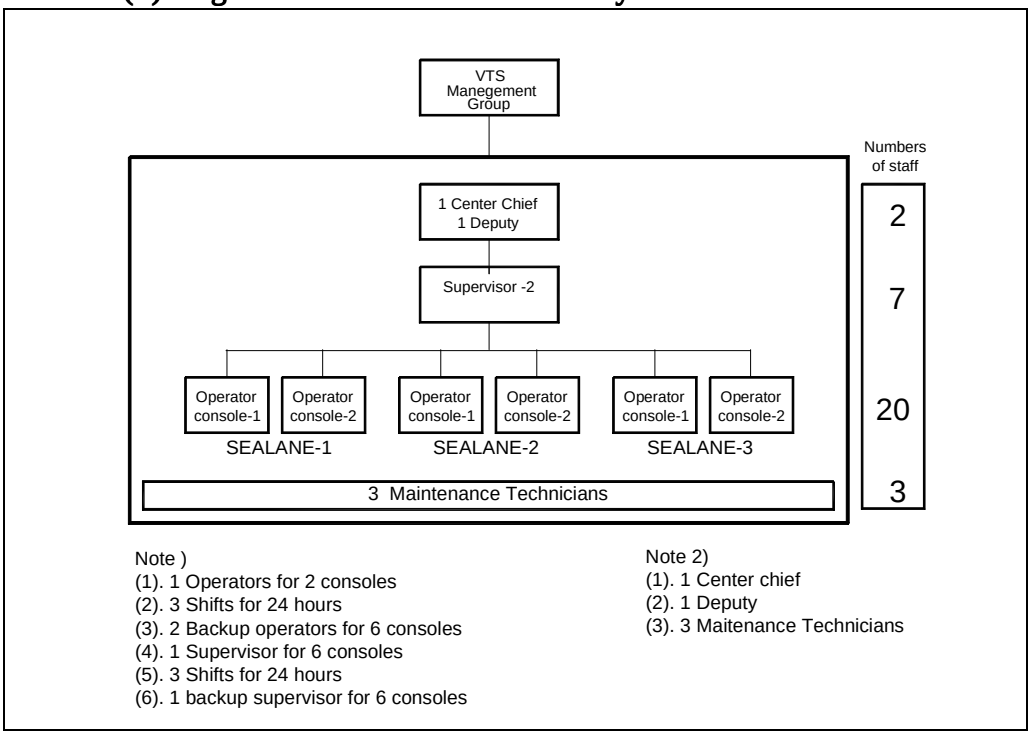
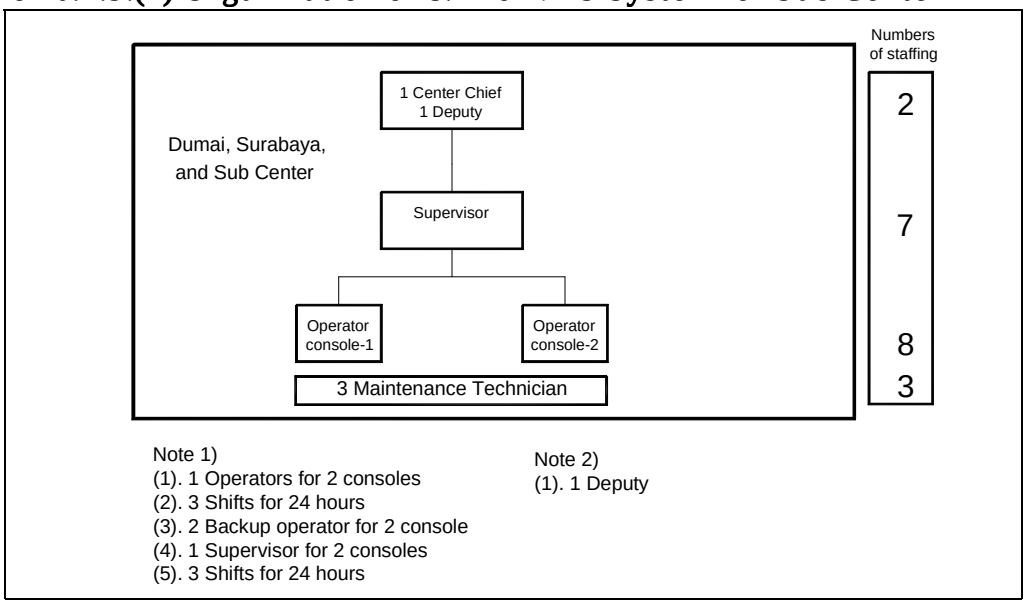


Figure 10.4.9.(2) Organization of O/M of VTS System for Sub Center



(2) Training for Operation staff

Training for Operator and Supervisor staff should be completed before the commissioning test of VTS system. Training program is comprised of two categories, one is “class room training” to study general items as maritime regulation, law and others. The other is “On-the-Job” training to familiarize actual operation of VTS system. The training items are operation of console,

operation of VHF radio, guidance method for vessels, communication with vessels and other related works.

(3) Training for Maintenance Staff

Training for Maintenance staff is comprised of "class room training" and "On-the-Job training". The "class room training" is study of concept of VTS system, hardware configuration, software configuration, spare parts allocation, system startup procedure, shutdown procedure, daily maintenance, diagnostic of failure and related items.

"On-the-Job training" is study of actual operation and maintenance by using VTS equipment. This training is carried out in manufacturer's factory or existing site.

10.4.10. Implementation Schedule

The location of project sites are spread nation widely. Phasing of schedule is useful for actual implementation work. Implementation schedule is divided into four phases. Detailed schedule of implementation is shown in **Table 10.4.10.**

Table 10.4.10. Installation Schedule for Each Station

Number of phase	Year of start	Year of End	Installation schedule for each phase.
Phase -1	2004	2007	1. Merak remote station (Radar and AIS), Merak ADPEL Sub Center. 2. Tanglad remote station (AIS), Benoa C/S Sub Center
Phase -2	2008	2011	1. Main Center. 2. Tanglad Radar remote station (Radar). 3. Natuna remote station (AIS) 4. Buttu Salonte remote station (AIS). 5. Alor remote station (AIS).
Phase -3	2012	2016	1. Improvement of Main Center. 2. Tanjung Lesung remote station (AIS). 3. Sarutu remote station (AIS). 4. Kalukalukuang remote station (AIS). 5. Buttu Tuopoang remote station (AIS). 6. Pulau Reong remote station (AIS). 7. Molu remote station (AIS) 8. Maru remote station (AIS).
Phase -4	2017	2020	1. Improvement of Main Center. 2. Sulabes remote station (AIS). 3. Mayu remote station (AIS).

10.4.11. Project Cost Estimation

(1) General

Plan-B indicated in **Figure 10.4.5.(2)** is selected as Master Plan that is comprised of one (1) Main Center, two (2) Sub Center, two (2) Radar/AIS station sites and twelve (12) AIS remote station sites.

Main Center is located at Jakarta in Java. Sub Center for Sunda Strait will be located at ADPEL Merak in Merak City and Sub Center for Lombok Strait is located at Benoa Coastal Station in Bali Island.

(2) Project Cost Estimation

Mater Plan will be formulated by four (4) phases as specified in **Table 10.4.10**. Project cost is estimated for each phase. Investment cost for each phase of Mater Plan is shown in **Table 10.4.11.**

Table 10.4.11. Summarized Project Cost of Mater Planz

Unit: Thousand US$

Description	Phase-1		Phase-2		Phase-3		Phase-4		Sub total	
	Foreign	Local	Foreign	Local	Foreign	Local	Foreign	Local	Foreign	Local
Procurement of equipment	3,667	-	6,163	-	2,256	-	1,348	-	13,435	-
Installation and setup	613	-	996	-	665	-	171	-	2,446	-
Spare parts	94	-	127	-	53	-	24	-	298	-
Civil works	164	416	286	1,842	-	3,531	-	1,126	449	6,916
Training	61	-	73	-	49	-	29	-	212	-
Engineering	652	-	950	-	540	-	446	-	2,587	-
Sub-total (Direct cost)	5,251	416	8,595	1,842	3,563	3,531	2,018	1,126	19,427	6,916
Ocean Transportation and packing	105	-	172	-	71	-	40	-	389	-
Contingency (5%)	263	21	430	92	178	177	101	56	971	346
Grand Total	5,619	437	9,196	1,934	3,812	3,708	2,160	1,182	20,788	7,261

10.5. GMDSS Expansion and Improvement

10.5.1. Introduction

In order to meet the requirement of SOLAS Convention, DGSC installed HF DSC at 12 stations, MF and VHF DSCs at 30 stations and International NAVTEX transmitters at 4 stations under the Maritime Telecommunication System Project Phase Ⅲ and other projects.

Table 10.5.1. shows the list of coast stations where GMDSS is installed at present.

There are no more needs to deploy HF DSC stations for Sea Area A3. However, there still remain blind zones at Sumatra, Kalimantan, Sulawesi and Irianjaya which need to be covered by MF DSC for Sea Area A2, and also remain a number of coast stations for main ports, major feeder ports and important navigation waters which need provisions of VHF DSC for Sea Area A1.

Table 10.5.1. GMDSS Coast Stations at Present

Class			A3 HF DSC	A2 MF DSC	A1 VHF DSC	NAVTEX	Remarks
I	1	Belawan	○	○	○		
	2	Dumai	○	○	○		
	3	Jakarta	○	○	○	○	
	4	Surabaya	○	○	○		
	5	Makassar	○	○	○	○	
	6	Bitung	○	○	○		
	7	Ambon	○	○	○	○	
	8	Jayapura	○	○	○	○	
II	1	Semarang	○	○	○		
	2	Cilacap		○	○		
	3	Kupang	○	○	○		
	4	Balikpapan	○	○	○		
	5	Sorong	○	○	○		
III	1	Sibolga		○	○		
	2	Batu Ampar		○	○		
	3	Sei Kolak Kijang		○	○		Eq'pt from Tg.Pinang
	4	Panjang		○	○		
	5	Benoa		○	○		
	6	Lembar		○	○		
	7	Pontianak		○	○		
	8	Tarakan		○	○		
	9	Kendari		○	○		
	10	Pantoloan		○	○		
	11	Ternate		○	○		
	12	Manokwari		○	○		
	13	Biak		○	○		
	14	Merauke		○	○		
IV	1	Tahuna		○	○		
	2	Sanana		○	○		
	3	Fak-fak		○	○		
Total No. of Station			12	30	30	4	

International NAVTEX area is already covered by existing Jakarta, Makassar, Ambon and Jayapura coast stations, and the stations of neighboring countries. However, National NAVTEX which secures the safety of navigation for coastal and inter-islands shipping has not been established yet in Indonesia.

10.5.2 Concept of GMDSS Expansion and Improvement

The Republic of Indonesia, as a big maritime state in the world, has a vital responsibility for an early establishment of maritime distress and safety telecommunication system, therefore the following expansion and improvement of GMDSS should be implemented as soon as possible:

(1) Expansion of GMDSS Coverage

a. To establish Sea Area A2 in all the coastal waters, and form MF DSC watch system,

b. To establish Sea Area A1 for waters in and around main ports, major feeder ports and important navigation waters, and form VHF DSC watch system.

(2) Introduction of National NAVTEX

a. To introduce and commence National NAVTEX service in Indonesian language.

The above GMDSS expansion and improvement should be implemented by the following two steps:

[Urgent Project]

- To cover major blind zones by MF DSC.
- To cover waters in and around main ports and important navigation waters by VHF DSC.
- To commence National NAVTEX service using a frequency for International NAVTEX, 518 kHz.
- To notify the stations list for GMDSS to IMO after the completion of the above.

[Additional Project]

- To cover small blind zones by MF DSC.
- To cover major feeder ports and important navigation waters by VHF DSC.
- To implement the full operation of National NAVTEX service using a frequency for National NAVTEX, 490 kHz.

10.5.3. Expansion of GMDSS Coverage

(1) To establish Sea Area A2

[Urgent]

The following 19 existing stations should be installed with MF DSC to cover major blind zones:

1st class : 1 station
2nd class : 3 stations
3rd class : 2 stations
4th class :13 stations

[Additional]

The following 10 stations should be installed with MF DSC to cover small blind zones:

4th class (exist) : 7stations
(new) : 3 stations

Figure 10.5.1. shows the expansion coverage for Sea Area A2 by Urgent and Additional Projects.

(2) To establish Sea Area A1

[Urgent]

The following 33 existing stations should be installed with VHF DSC to cover around main ports and important navigation waters:

1st class : 1 station
2nd class : 3 stations
3rd class : 5 stations
4th class :24 stations

[Additional]

The following 15 stations should be installed with VHF DSC to cover around major feeder ports and important navigation waters:

4th class (exist) :12 stations
(new) : 3 stations

Figure 10.5.2. shows the expansion coverage for Sea Area A1 by Urgent and Additional Projects.

10.5.4. Introduction of National NAVTEX

[Urgent]

A frequency for international NAVTEX, 518 kHz, will be utilized. The use of this frequency is limited to the message only in the “VITAL” or “IMPORTANT” categories. However, message can be received by receivers of International NAVTEX without any modification, as the Indonesian alphabet is the same as English. And the present International NAVTEX stations (Jakarta, Makassar, Ambon and Jayapura) are used for the above purpose.

[Additional]

A frequency for National NAVTEX, 490 kHz, will be utilized. A full operation of National NAVTEX services will be possible, but a development of ship’s receivers for this frequency is required.

Belawan station, in addition to the above 4 stations, will be used for this National NAVTEX services to cover northern Sumatra.

All above implementations and its related stations are summarized in **Table 10.5.2.**

10.5.5. Implementation Schedule

Implementation Schedules for expansion and improvement of GMDSS and NAVTEX are shown in **Table 10.5.3.**

Figure 10.5.1. GMDSS Coverage Area (A2, Expansion)

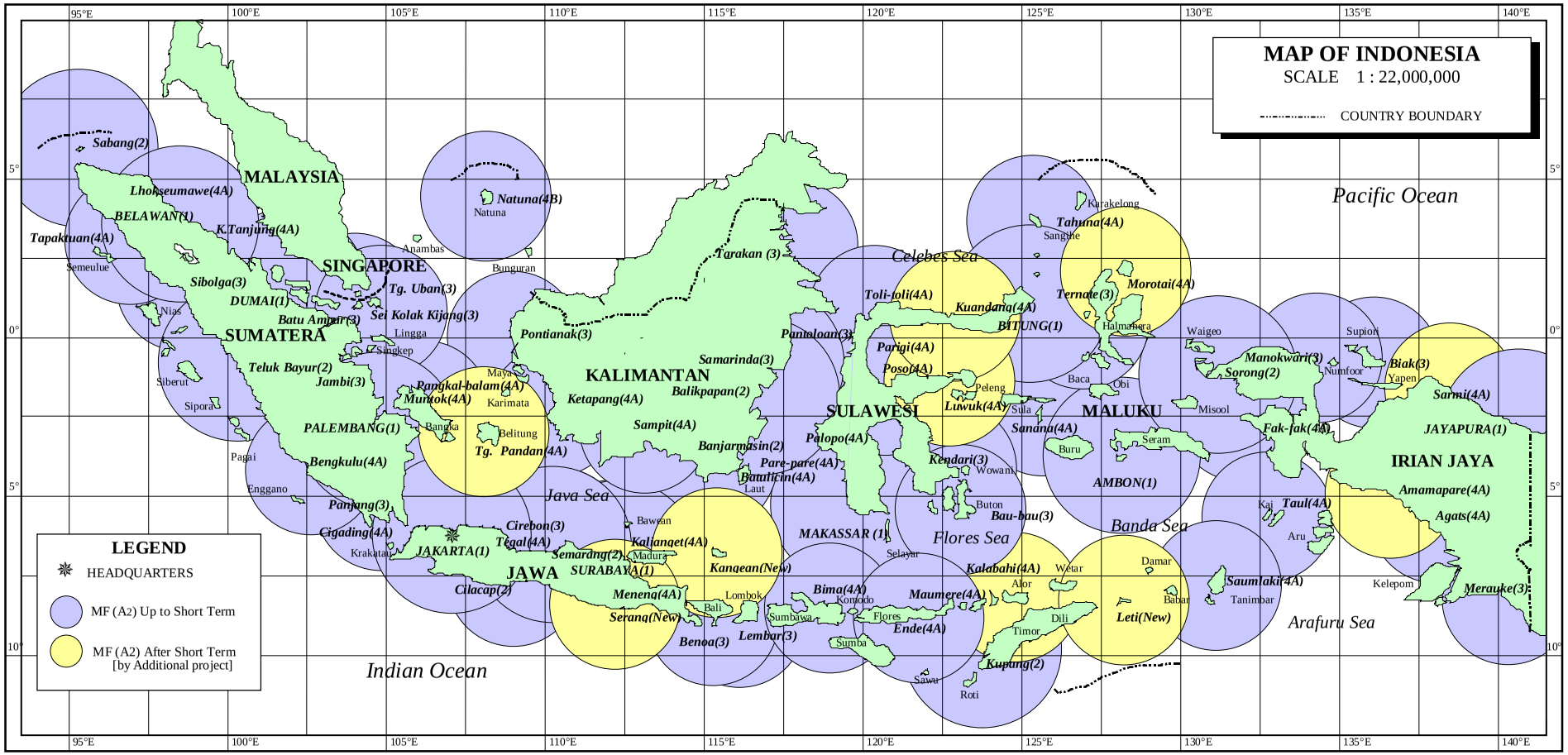


Figure 10.5.2. GMDSS Coverage Area (A1, Expansion)

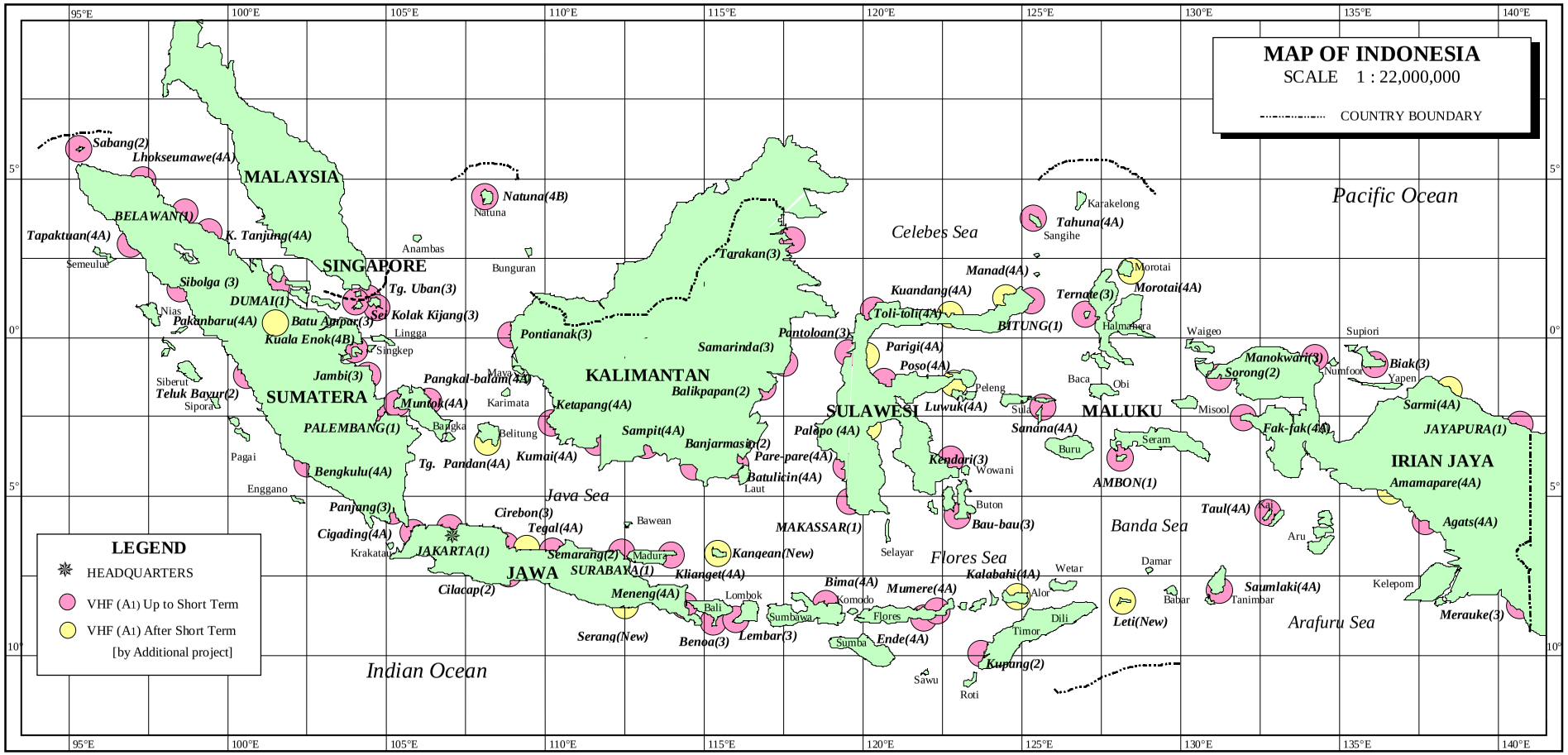


Table 10.5.2. Expansion and Improvement Plan for GMDSS

Class		Name	A3	A2	A1	NAVTEX		Improvement				
			HF DSC	MF DSC	VHF DSC	International	National	Separation	Relocation	VHF Area	E/G	Antenna
I	1	Belawan	▲	▲	▲		○				◎	◎
	2	Dumai	▲	▲	▲					◎	◎	◎
	3	Palembang		◎	◎						◎	◎
	4	Jakarta	▲	▲	▲	▲	◎				◎	◎
	5	Surabaya	▲	▲	▲				◎		◎	
	6	Makasar	▲	▲	▲	▲	◎		◎		◎	
	7	Bitung	▲	▲	▲						◎	◎
	8	Ambon	▲	▲	▲	▲	◎				◎	◎
	9	Jayapura	▲	▲	▲	▲	◎				◎	◎
II	1	Sabang		◎	◎			○			◎	◎
	2	Teluk Bayur		◎	◎			◎				
	3	Semarang	▲	▲	▲						◎	
	4	Cilacap		▲	▲			○				
	5	Kupang	▲	▲	▲							◎
	6	Banjarmasin		◎	◎						◎	◎
	7	Balikpapan	▲	▲	▲						◎	◎
	8	Sorong	▲	▲	▲						◎	◎
III	1	Sibolga		▲	▲							
	2	Batu Ampar		▲	▲							
	3	Tg. Uban			◎							
	4	Sei Kolak Kijang		▲	▲							
	5	Jambi			◎							
	6	Panjang		▲	▲							
	7	Cirebon			◎							
	8	Benoa		▲	▲			◎				
	9	Lembar		▲	▲							
	10	Pontianak		▲	▲							
	11	Samarinda		◎	◎					◎		
	12	Tarakan		▲	▲							
	13	Kendari		▲	▲							
	14	Bau-bau		◎	◎							
	15	Pantoloan		▲	▲							
	16	Ternate		▲	▲							
	17	Manokwari		▲	▲							
	18	Biak		▲	▲							
	19	Merauke		▲	▲							
IV	1	Tapaktuan		◎	◎							
	2	Kuala Tanjung			◎							
	3	Lhokseumawe			◎							
	4	Pekanbaru			○							
	5	Kuala Enok			◎							
	6	Natuna		◎	◎							
	7	Muntok			◎							
	8	Pangkal Balam		◎	◎							
	9	Tg. Pandan		○	○							
	10	Bengkulu		◎	◎							
	11	Cigading			◎							
	12	Tegal			○							
	13	Kalianget			◎			*Remarks*				
	14	Meneng (Banyuwangi)			◎			** marked station is the new station, i.e.,*				
	15	Serang *(*)*		○	○			*they were not listed up on the existing*				
	16	Kangean *(*)*		○	○			*"221 stations" list.*				
	17	Bima		◎	◎							
	18	Ende		◎	◎							
IV	19	Maumere			◎							
	20	Kalabahi		○	○							
	21	Lati *(*)*		○	○							
	22	Ketapang		◎	◎							
	23	Sampit		◎	◎							
	24	Kumai			◎							
	25	Batulicin			◎							
	26	Pare-pare			◎							
	27	Palopo			○							
	28	Luwuk		○	○							
	29	Poso		◎	◎							
	30	Toli-toli		◎	◎							
	31	Manado			○							
	32	Tahuna		▲	▲							
	33	Parigi			○							
	34	Kuandang		○	○							
	35	Tual		◎	◎							
	36	Morotai		○	○							
	37	Saumlaki		◎	◎							
	38	Sanana		▲	▲							
	39	Fak-fak		▲	▲							
	40	Amamapare		○	○							
	41	Sarmi		○	○							
	42	Agats		◎	◎							
Total Existing			12	30	30	4	-					
Total Expansion (Urgent)			**-**	**19**	**33**	**-**	**4**	**2**	**2**	**2**	**14**	**12**
Total Expansion (Future)			**-**	**10**	**15**	**-**	**1**	**2**	**-**	**-**	**-**	**-**
Grand Total			12	59	78	4	5	4	2	2	14	12

Note: ▲ Existing
◎ **New (Urgent)**
○ **New (Additional)**

Table 10.5.3. Implementation Schedule of Master Plan for Maritime Telecommunications System

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Calendar Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
GMDSS		Urgent GMDSS (Phase-IV)																		
							Remaining GMDSS & National NAVTEX													
Ship Reporting System			by DSC/NBDP and VHF-AIS																	
								Long range AIS												
Telecom System																				
1) Up-grading of Internal Telecom System			(1st Stage) by Existing HF and Internet/WAN																	
								(2nd Stage) Internet/WAN, VSAT or Digital HF												
														(3rd Stage) Internet/WAN, VSAT or Digital HF						
2) Integration of Coastal Radio Station															(to be remotely controlled and supervised)					
														Integration of 3rd and 4th class Stations						
3) Up-grading of DGSC Ship's Telecom Equipment								(1st Stage) Large-scale Ships												
														(2nd Stage) Middle-scale Ships						
4) Replacement and Improvement of Aged Equipment/Facilities		(1st Stage) Urgent Replacement & Improvement																		
								(2nd Stage) GMDSS Phase-1&2's Equipment												
														(3rd Stage) GMDSS Phase-3's Equipment						

Note: AIS; Automatic Identification System

10.5.6. Cost Estimate

Implementation costs for the expansion and improvement of GMDSS and NAVTEX through out this long term period are estimated as the amounts in **Table 10.5.4.**

Table 10.5.4. Implementation Costs for GMDSS and NAVTEX

Unit: Thousand US$

	Expansion of A1 and A2 areas	NAVTEX	Total
Urgent project	22,014	-	22,014
Additional project	19,866	2,888	22,754
Total	41,880	2,888	44,768

10.6. Indonesia Ship Reporting System

10.6.1 Introduction

"International Convention on Maritime Search and Rescue (SAR Convention) 1979" which has become effective since 1985, recommends a contracting Government to establish a ship reporting system for application within its search and rescue region for which it is responsible, where this is considered necessary to facilitate search and rescue operations and is deemed practicable.

In Asia-Pacific region, many systems have been established and operated, such as AMVER (United State), AUSREP (Australia), JASREP (Japan), INSPIRES (India), STRAITREP (The Strait of Malacca and Singapore), KOSREP (Korea) and CHISREP (China), and these have greatly contributed to maritime safety, especially in the sea areas of less rescue forces.

Ship reporting systems are in these days used to provide data for many purposes, not only search and rescue but also preventing marine pollution, countermeasures for crimes at sea, etc.

10.6.2. Establishment of Indonesia Ship Reporting System

Recognizing that SAR Convention recommends the establishment of a Ship Reporting System which greatly contributes to maritime search and rescue and the prevention of marine pollution, and considering that Republic of Indonesia, as a big maritime state in the world, has a vital responsibility for ensuring maritime safety and protecting marine environment, Indonesia Ship Reporting System should be planned and implemented as early as possible. This system is recommended to introduce separately in two stages as follows:

[1st stage]

Existing DSC/NBDP at major coast stations (1st, 2nd and 3rd class) should be utilized.

In addition, Automatic Identification System (AIS), using VHF and to be installed on vessels from 2002, should be introduced at the 1st and the 2nd class coast stations in order to adopt an automatic position-detecting system.

[2nd stage]

The introduction of AIS using VHF should be expanded to the 3rd class coast stations.

In Addition, a long range application of AIS which is now under technological study at International Telecommunication Union (ITU), will be utilized.

10.6.3. Concept of Indonesia Ship Reporting System

(1) System's Name

Indonesia Ship Reporting System is tentatively called INDOSREP.

(2) Area to be covered

Indonesian Search and Rescue Region (SRR) will be suggested as a reporting area in accordance with SAR Convention.

However, this area is too complicated and does not seem to be practical for a ship reporting system. Therefore, further study including negotiations with neighboring countries is required to make a practical reporting area.

(3) Participating Ships

Basically, any kinds of vessels regardless of nationality are welcomed. Further study for categories on participating ships, based on relevant various regulations and current situation of maritime traffic, is required.

(4) Type of Report

The following reports are recommendable from the IMO Resolution A.851 (20):

General Reports;

① Sailing plan (SP)
② Position report (PR)
③ Deviation report (DR)
④ Final report (FR)

Special Reports;

① Dangerous goods report (DG)
② Harmful substances report (HS)
③ Marine pollutants report (MP)

(5) Reporting Interval

Basically within 24 hours. But further study, based on the features of an archipelagic Indonesian waters and the current situation of maritime traffic, is required.

(6) Implementing Authority

Director General of Sea Communication, Ministry of Communication

10.6.4. System Composition

System configuration of INDOSREP is shown in **Figure 10.6.1.**

(1) Report Receiving Station

Report Receiving Station（Receiving Station）will be set up at the major coast stations (1st, 2nd and 3rd class) by the following two stages:

[1st Stage]

The Receiving Station receives reports from participating ships by;

HF DSC/NBDP	: 1st and 2nd class stations,
MF DSC/NBDP	: 1st, 2nd and 3rd class stations,
VHF AIS	: 1st and 2nd class stations,

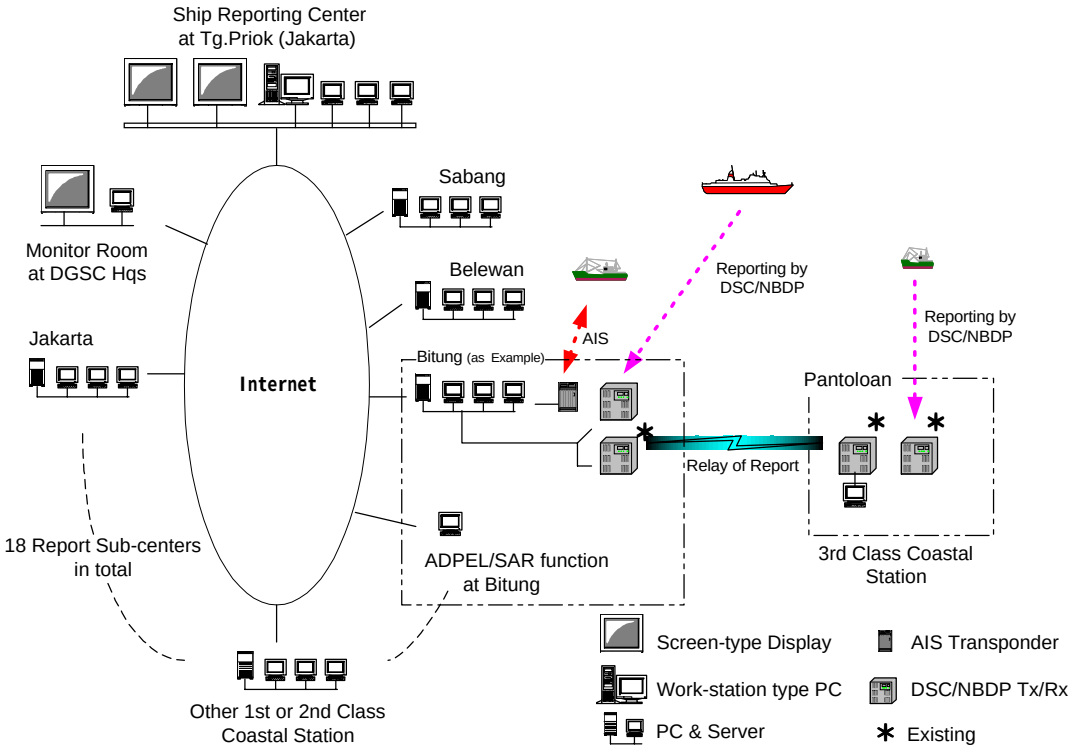
INMARSAT, e-mail, or other public networks.

The 3rd class station sends the reports to each Report Sub-Center.

[2nd Stage]

In addition to the above, VHF AIS will be expanded to the 3rd class stations, and a long range AIS will be introduced.

Figure 10.6.1. System Configuration of INDOSREP



(2) Report Sub-Center

Report Sub-Center (Sub-Center) will be set up at the 1st and the 2nd class coast stations.

Sub-Center collects reports directly from participating ships or the 3rd class coast stations, and sends the data to Ship Reporting Center at Jakarta.

Sub-Center receives processed data from Ship Reporting Center and send the data to ADPEL and other SAR related organizations as needed.

(3) Ship Reporting Center

Ship Reporting Center (Center) will be set up at Tg. Priok in Jakarta. The Center collects, process, analyzes and stores various reports received from Sub-Centers or directly from ships through INMARSAT and other public networks.

Center sends the processed data to Sub-Centers, and to DGSC, ARMADA and SAR related organizations as needed.

(4) Network

Telecommunication network for the report transmission is as follows:

[1st Stage]

Center	~	Sub-Center	: Internet / Existing HF
Sub-Center	~	3rd class station	: Existing HF

[2nd Stage]

Center	~	Sub-Center	: Internet / VSAT or Digital HF
Sub-Center	~	3rd class station	: VSAT or Digital HF / Existing HF

Figure 10.6.2.and **Table 10.6.1.** show the project sites for INDOSREP.

10.6.5. Implementation Schedule

Implementation schedule of INDOSREP is shown in **Table 10.5.3. of Section 10.5.**

Figure 10.6.2. Project Sites of Ship Reporting System

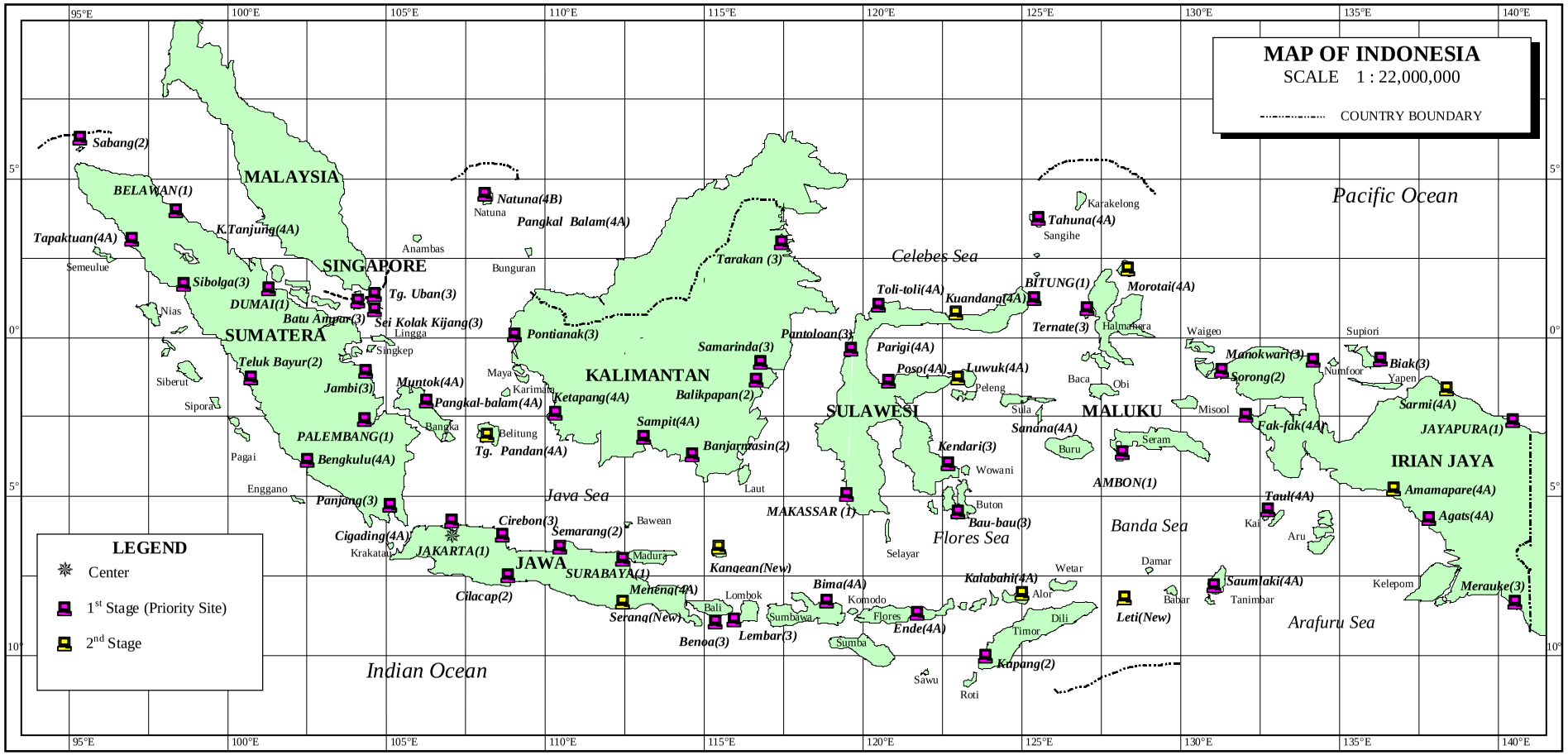


Table 10.6.1. Establishment and Expansion Plan for Ship Reporting System

Class		Name	Center	Sub-center	Controlling & Monitoring	(A3) HF DSC/NBDP	(A2) MF DSC/NBDP	(A1) VHF AIS	HF Long-range AIS	INMARSAT AIS
		Center (at Tg. Priok)	○		◎					
		Monitor Room (at HQ)			◎(Monitoring)					
I	1	Belawan		○		◎	◎	◎	○	
	2	Dumai		○		◎	◎	◎	○	
	3	Palembang		○			◎	◎		
	4	Jakarta		○		◎	◎	◎	○	○
	5	Surabaya		○		◎	◎	◎	○	
	6	Makasar		○		◎	◎	◎	○	
	7	Bitung		○		◎	◎	◎	○	
	8	Ambon		○		◎	◎	◎	○	
	9	Jayapura		○		◎	◎	◎	○	
II	1	Sabang		○			◎	◎		
	2	Teluk Bayur		○			◎	◎		
	3	Semarang		○		◎	◎	◎	○	
	4	Cilacap		○			◎	◎		
	5	Kupang		○		◎	◎	◎	○	
	6	Banjarmasin		○			◎	◎		
	7	Balikpapan		○		◎	◎	◎	○	
	8	Sorong		○		◎	◎	◎	○	
III	1	Sibolga					◎	○		
	2	Batu Ampar					◎	○		
	3	Tg. Uban						○		
	4	Sei Kolak Kijang					◎	○		
	5	Jambi						○		
	6	Panjang					◎	○		
	7	Cirebon						○		
	8	Benoa		○			◎	◎		
	9	Lembar					◎	○		
	10	Pontianak					◎	○		
	11	Samarinda					◎	○		
	12	Tarakan					◎	○		
	13	Kendari					◎	○		
	14	Bau-bau					◎	○		
	15	Pantoloan					◎	○		
	16	Ternate					◎	○		
	17	Manokwari					◎	○		
	18	Biak					◎	○		
	19	Merauke					◎	○		
IV	1	Tapaktuan					◎	○		
	2	Kuala Tanjung								
	3	Lhokseumawe								
	4	Pekanbaru								
	5	Kuala Enok								
	6	Natuna					◎	○		
	7	Muntok								
	8	Pangkal Balam					◎	○		
	9	Tg. Pandan					○	○		
	10	Bengkulu					◎	○		
	11	Cigading								
	12	Tegal								
	13	Kalianget								
	14	Meneng (Banyuwangi)								
	15	Serang (*)					○	○		
	16	Kangean (*)					○	○		
IV	17	Bima					◎	○		
	18	Ende					◎	○		
	19	Maumere								
	20	Kalabahi					○	○		
	21	Lati (*)					○	○		
	22	Ketapang					◎	○		
	23	Sampit					◎	○		
	24	Kumai								
	25	Batulicin								
	26	Pare-pare								
	27	Palopo								
	28	Luwuk					○	○		
	29	Poso					◎	○		
	30	Toli-toli					◎	○		
	31	Manado								
	32	Tahuna					◎	○		
	33	Parigi								
	34	Kuandang					○	○		
	35	Tual					◎	○		
	36	Morotai					○	○		
	37	Saumlaki					◎	○		
	38	Sanana					◎	○		
	39	Fak-fak					◎	○		
	40	Amamapare					○	○		
	41	Sarmi					○	○		
	42	Agats					◎	○		
Total Expansion (1st Stage)					**2**	**12**	**49**	**18**	**-**	**-**
Total Expansion (2nd Stage)					**-**	**-**	**10**	**44**	**12**	**1**
Grand Total					2	12	59	62	12	1

Remarks
* marked station is the new station, i.e., they were not listed up on the existing "221 stations" list.

Note: ◎ **New (1st Stage)**
○ **New (2nd Stage)**

10.6.6. Cost Estimate

Implementation costs for establishment and expansion of INDOSREP are estimated as shown in **Table 10.6.2.**

Table 10.6.2. Implementation Costs for Ship Reporting System

Unit: Thousand US$

	Center	Sub-Center (1st ,2nd class)	3rd class	Total
1st Stage	1,779	9,355	314	11,448
2nd Stage	1,224	1,386	3,812	6,422
Total	3,003	10,741	4,126	17,870

10.7. Telecommunications System

10.7.1. Up-grading of Internal Communication Network

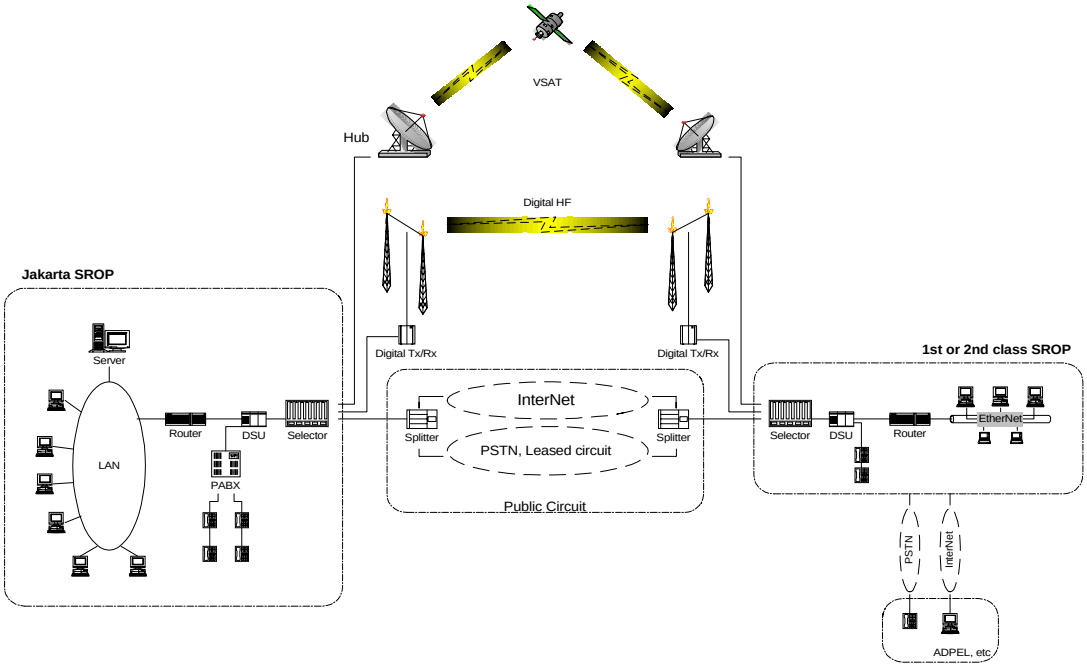
(1) General

DGSC has HF networks between Jakarta and main local coastal radio stations and among offices within regional area. This conventional analog HF system can deliver low speed telex signal and SSB voice signal only. Therefore, it is necessary to form the upgraded internal communication network in order to meet the recent DGSC's requirements for advanced information.

Recent development in the field of information and telecommunication is remarkable. **Figure 10.7.1.** shows possible transmission means in the next era of DGSC.

Selection of the system, i.e., which to be the main and which to be the back-up for the link, has been examined in views of cost, reliability, security, development schedule and so on.

Figure 10.7.1. A Concept of Internal Telecom System in the Next Era



(2) Comparison of transmission means

Table 10.7.1 shows the features of the each transmission mean.

Table 10.7.1. Features of Each Transmission Mean

		Cost		Nationwide Availability	Quality	Electrical Reliability	Security
		Initial	Running				
Public Circuit	Leased	Very limited	Very expensive	Up to major city & town	Very good	Very good	Secured
	Internet	Very limited	Cheep	Up to major city	Good	Good & bad (* *)	Not secured
Satellite	INMARSAT	Not so expensive	Expensive	Any where	Very good	Good	Secured basically
	Domestic	Very limited	Expensive	Any where	Very good	Good	Secured Basically
DGSC's Own Circuit	Analog HF	Expensive	Free of charge	Any where	Bad	Bad	Not secured
	Digital HF(*)	Expensive than analog	Free of charge	Any where	Good	Good	Secured

Remarks (*): The Tx/Rx separation type will be appeared around the year 2006.
(* *): It depends on the area, such as urban or rural.

(3) Improvement stages

Improvement for Internal Communication Network of DGSC should be promoted based on the following ideas:

- Hybrid system combing existing means and newly developed ones
- Implementation schedule by three stages

The improvement plan based on the above ideas is shown in **Table 10.7.2.**

Table 10.7.2. Improvement Stages for Internal Telecom System

	First Period	Middle Period	Later Period
Main Link			
Inter-city link (for 1st or 2nd class)	**Internet/WAN**	Internet/WAN	Internet/WAN
Inter-local link (for 3rd or 4th class)	(Existing) Analog HF	**VSAT** or **Digital HF**	**Internet/WAN**
Back-up Link			
Inter-city link (for 1st or 2nd class)	(Existing) Analog HF	**VSAT** or **Digital HF**	**VSAT**
Inter-local link (for 3rd or 4th class)	(Existing) Analog HF	Analog HF	**VSAT** or **Digital HF**
Form of Station	All stations are independent.	All stations are independent.	**Integrate 3rd/4th class** to 1st or 2nd class.
Message/Data to be Delivered	SAR correspondences Administrative information **Ship Reporting System** Data & **VHF AIS** data for **1st/2nd** class	SAR correspondences Administrative information Ship Reporting System Data & AIS data for 1st/2nd/**3rd** class & **Long range AIS** for 1st class	SAR correspondences Administrative information Ship Reporting System Data & AIS data for 1st/2nd/3rd class & Long range AIS for 1st class **Tx/Rx control & supervision** signals for 3rd/4th class

(4) Implementation schedule

The implementation schedule is shown in **Table 10.5.3.**

(5) Cost estimate

Implementation costs are estimated in **Table 10.7.3.**

Table 10.7.3. Improvement Cost for Internal Telecom System

Unit: Thousand US$

1st Stage	-
2nd Stage	3,100
3rd Stage	1,800
Total	4,900

(6) Remarks

At the meeting on Interim Report, Up-grading of Internal Communication Network was selected as a Priority Project.

However, as listed in **Table 10.7.2**, Internal Communication Network was recommended to be made by the existing analog HF and/or internet system at the 1st stage.

The internet has been started in the information system against piracy and armed robbery, so called Maritime Safety Information System (MSIS) of DGSC from November 2001, and planned to be utilized for data transmission of Indonesia Ship Reporting System at the 1st stage.

Therefore JICA Study Team proposed to cancel Feasibility Study for up-grading of Internal Communication Network, and DGSC agreed it.

10.7.2. Integration of Coastal Radio Stations

(1) General

DGSC has deployed 221 coastal radio stations throughout Indonesia, and these stations are operated individually because of the poor land telecommunication network of DGSC at present.

To achieve more accurate and reliable operation of entire maritime safety communication, it is desirable that a key coastal radio station remotely operates distant transmitters and receivers within its DISNAV area.

(2) Integration concept of coastal radio stations

In the integration, the 1st and 2nd class stations will take the position of the key stations, then operate the 3rd or 4th class station's transmitters and

receivers using a remote control and supervisory equipment and new linking system.

As for linking system, higher speed and reliable transmission means are required, and this will be realized by satellite system, such as VSAT (Very Small Aperture Terminal).

Therefore, this integration should be implemented in conjunction with the 3rd stage of the above "Up-grading of Internal Communication Network" project.

Key stations and integrated stations after the integration will be as follows:

Key station (1st and 2nd class)	:	24 stations (one station in each DISNAV)
Integrated station (3rd and 4th class)	:	54 stations (stations in charge of maritime safety communication)

(3) Implementation schedule

The implementation schedule is shown in **Table 10.5.3.**

(4) Cost estimate

Implementation costs are estimated as **US$ 30,000,000**.

10.7.3. Up-grading of DGSC Ship's Telecommunication Equipment

(1) General

Maritime telecommunication at present is based on analog technology. In order to provide the new services such as e-mail and internet access, digital maritime telecommunication system is being discussed at the International Telecommunication Union (ITU).

After the conclusion is issued at ITU, telecommunication system of DGSC ships should be up-graded.

(2) Up-grading of DGSC ship's telecommunication equipment

DGSC has two categories of ships; patrol ships belonging to GAMAT and aids to navigation ships belonging to NAVIGASI.

Ships of both categories are classified into 5 classes, the 1st of the biggest to the 5th of the smallest.

At the up-grading of telecommunication equipment;

a. Class Ⅰ and Ⅱ will be installed with a long range communication

system at the 1st stage,

b. Class Ⅲ and Ⅳ will be installed with a middle range communication system at the 2nd stage, and

c. Class Ⅴ can communicate by portable type transceivers.

(3) Implementation schedule

The implementation schedule is shown in **Table 10.5.3.**

(4) Cost estimate

Up-grading costs are estimated in **Table 10.7.4.**

Table 10.7.4. Up-grading Cost for Ship's Telecom Equipment

Unit: Thousand US$

1st Stage	8,600
2nd Stage	9,800
Total	18,400

10.7.4. Replacement and Improvement of Aged Equipment/Facilities

(1) General

DGSC has deployed 221 coast stations throughout Indonesia and owns a number of equipment/facilities.

Many equipment and facilities were modernized by the Maritime Telecommunication System Projects Phase-Ⅰ,Ⅱ and Ⅲ, nevertheless there still remain problems such as aging of equipment/facilities and on environment of radio wave. Most of the problems are serious, then these are to be solved urgently in order to cope with the current maritime telecommunication needs, such as GMDSS.

(2) Improvement of coast stations for enabling them to cover GMDSS

The following improvement for coast stations should be executed urgently in synchronization with the project of GMDSS expansion:

a. Separation of transmitting and receiving station

Teluk Bayur (2nd class)

Benoa (3rd class)

b. Improvement of environment for coast stations

Surabaya (1st class)

Makassar (1st class)

c. Improvement of VHF coverage
Dumai (1st class)
Samarinda (3rd class)

d. Improvement of engine-generators
1st and 2nd class stations

e. Replacement of old antennas
1st and 2nd class stations

(3) Replacement of aged equipment

The lifetime of telecommunication equipment expires 15 years generally. After 15 years, the provision of spares from the manufacturers is also very difficult.

From that, the equipment installed at Phase Ⅰ, Ⅱ and Ⅲ Project should be replaced or updated in certain time.

(4) Implementation schedule

Three (3) stages are considered.

1st stage : Improvement of coast stations for enabling them to cover GMDSS
2nd stage : Replacement of equipment installed by Phase Ⅰ and Ⅱ
3rd stage : Replacement of equipment installed by Phase Ⅲ

Implementation schedules for the above stages are shown in **Table 10.5.3.**

(5) Cost estimate

Replacement and improvement cost are estimated in **Table 10.7.5.**

Table 10.7.5. Cost for Improvement of Equipment

Unit: Thousand US$

1st Stage	17,787
2nd Stage	20,000
3rd Stage	20,000
Total	57,787

10.8. Master Plans summarized

The Master Plans up to year 2020 is divided into two fields, one is aids to navigation and another is telecommunications system.

The field of aids to navigation consists of four (4) kinds of Master Plan that are "**Visual Aids to Navigation**", "**Radio Aids to Navigation**", "**Supporting Facilities**" and "**VTS system**", and those project costs are estimated at **US$101.843**, **38.122, 211.024** and **28.049 million** respectively. The total estimated cost for aids to navigation field is **US$379.038 million.**

Another field of telecommunications system consists of three (3) kinds of Master Plan that are **"GMDSS**", "**Ship Reporting System**" and "**Telecommunications System**", and those project costs are estimated at **US$44.768, 17.870** and **111.087 million** respectively. The total estimated cost for telecommunications system field is **US$173.725 million.**

The grand total of estimated project costs for the Master Plans up to year 2020 is **US$552.763 million.**

The Master Plans summarized with implementation schedule and estimated project costs are shown in **Table 10.8.1.**

Table 10.8.1. Implementation Schedule and Estimated Cost for Master Plans up to Year 2020

Unit: Million US$

		Items	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Cost (Million.US$)	
Aids to Navigation	Visual Aids to Navigation	Rehabilitation and Improvement (Light House:35, Light Beacon:231, Light Bouy:61)																				101.843	
		New Development (Light House :91, Light Beacon:322, Light Buoy:350)																					
	Radio Aids to Navigation	New Development (DGPS Station:15, Monitoring Center:1)																				32.100	38.122
		Rehabilitation and Improvement(Radar Beacon Stations: 50)																				6.022	
	Supporting Facilities	Vessels: Development 35, Rehabilitation 33																				190.259	211.024
		Development (Improvement) Buoy Bases:15(9), Open Strage:20(3), Workshop:0(15), Storage 4(0), Jetty:10(4)																				20.765	
	VTS System	New Development(Main Center:1, Sub Center:2, Remote Site:16)																				28.049	
													Aids to Navigation Sub Total									379.038	
Telecommunications System	GMDSS	Installation of MF DSC for Sea Area A2 (29)																				41.880	44.768
		Installation of VHF DSC for Sea Area A1 (48)																					
		Installation of National NAVTEX (5)																				2.888	
	Ship Reporting System	Installation of Report Receiving Stations in existing Coast Stations (44)																				4.126	17.87
		Installation of Report Sub-Centers (18) in existing Coast Stations																				10.741	
		Installation of Ship Reporting Center in Jakarta Coast Station (1)																				3.003	
	Telecomm. System	Up-grading of Internal Communication Network																				4.900	111.087
		Integration of Coast Stations																				30.000	
		Up-grading of Radio Equipment for DGSC's Fleet																				18.400	
		Replacement and Improvement of aged Equipment and Facilities																				57.787	
													Telecommunications System Sub Total									173.725	
													Master Plans Total Cost									552.763	

Implementation without Cost

Implementation with Cost

CHPTER 11.
SHORT TERM PLANS UP TO YEAR 2007

11.1. Visual Aids to Navigation

The sites in the Short-term Plan for visual aids to navigation are selected from the Master Plan. Total number of each visual aids to navigation is shown in **Table 11.1.1**.

Rehabilitation means to restore original condition and improvement means to raise the functions of existing visual aids to navigation, and the both start with the development plan simultaneously.

Table 11.1.1 Total Number of Visual Aids to Navigation for Short Term Plan

	Development	Rehabilitation and improvement
Lighthouse	18 units	35 units
Light beacons	61 units	176 units
Light buoy	125 units	61 units

(1) Rehabilitation and Improvement Plan

Lighthouses and Light beacons for rehabilitation and improvement plan were selected considering the following aspects in the Master plan;

- Operation status,
- Lantern condition,
- Power supply conditions,
- Structure condition.

(2) Development Plan

Lighthouses and Light beacons for short plan were selected considering following aspects in the Master Plan

- Sea lane
- Traffic route
- Dangers on route
- Marine casualty

(3) Implementation Schedule

Implementation schedule of Short-term Plan is shown in **Table 11.1.2.**

Table 11.1.2. Implementation Schedule of Short Term Plan

	Type of VATN	Phase	Unit	Master Plan									
				01	02	03	04	05	06	07	08	09	10
Rehabili - tation	Light-house	Phase1	21										
		Phase2	14										
	Light Bacon	Phase1	131										
		Phase2	45										
	Light Buoy	Phase1	61										
Develop - ment	Light-house	Phase1	8										
		Phase2	10										
	Light Bacon	Phase1	33										
		Phase2	28										
	Light Buoy	Phase1	34										

(4) Cost Estimate

The cost required for Short-term Plan of visual aids to navigation is shown in **Table 11.1.3.**

There are included cost of rehabilitation for visual aids to navigation.

Table 11.1.3 Total Project Cost for Short Term Plan

Unit: Thousand US$

	Phase 1	Phase 2	Total
A.. Equipment supply	12,955	7,902	20,857
B. Civil and houseing works	3,138	1,646	4,784
C. Instalation works	1,248	679	1,927
D. Transportation	433	266	699
E.. Consulting Services	1,777	1,050	2,827
Sub-total	19,551	11,543	31,094
Contigency (5%)	978	577	1,555
Total	20,529	12,120	32,649

11.2. DGPS

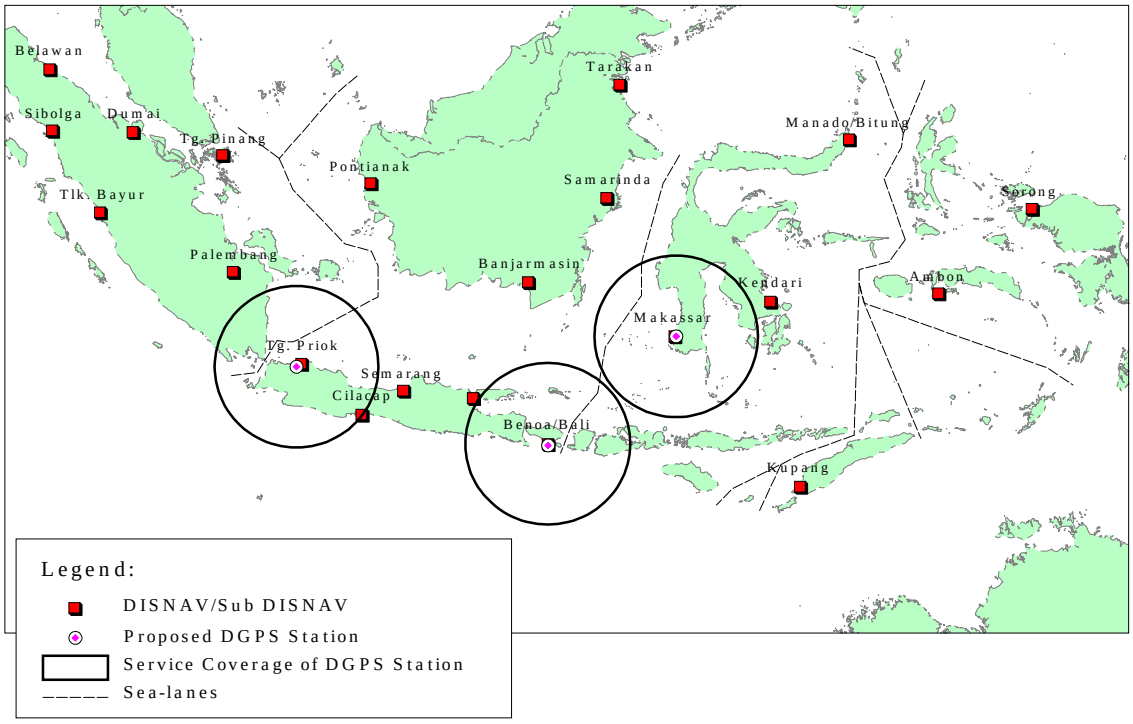
11.2.1. Selection of Locations of DGPS Stations for Short Term Plan

The project sites for Short Term Plan should be selected among the fifteen (15) proposed DGPS stations with priority specified in Master Plan up to 2020. When the project sites are selected for the Short Term Plan, designated three (3) sea lanes in archipelagic waters for the passage of foreign ships on international voyage must be considered as a policy of GOI. Selection work for Project sites was carried out in consideration of present status of navigation. Three (3) locations of proposed DGPS stations are finally selected for the Short Term Plan as shown in **Table 11.2.1.** Service coverage of DGPS Stations is shown in **Figure 11.2.1.**

Table 11.2.1. Locations for the Short Term Plan

NO	NAME	CLASS	LATITUDE	LONGUITUDE	Priority
6	Jakarta	I	06-07-08S	106-51-47E	1
9	Benoa	III	08-44-35S	115-12-32E	4
15	Makassar	I	05-06-34S	119-26-31E	2

Figure 11.2.1 Service Coverage of Proposed DGPS Stations in Short Term Plan



To manage and maintain accuracy of GPS and its related facilities, DGPS Managing Group will be established in Jakarta. This Managing Group will be established in Directorate of Navigation of DGSC before the project is started.

The DGPS Managing Group should have all responsibilities on the management and maintenance of all DGPS to be established in Indonesia.

11.2.2. Implementation Schedule of DGPS Stations for Short Term Plan

Implementation schedule of Short Term Plan for DGPS Stations is shown in **Table 11.2.2.**

Table 11.2.2. DGPS Implementation Schedule

Site No.	Site Name	Year									
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2015
06	Jakakarta										
09	Benoa										
15	Makassar										

11.2.3. Cost Estimate for Short Term Plan

The estimated project cost for the Short Term Plan is shown in **Table 11.2.3.**

Table 11.2.3. Project Cost for Short Term Plan

Unit: Thousand US$

Phase / Description	I
1. Procurement Cost	3,879
2. Installation and setup	404
3. Spare Parts	465
4. Civil and Housing Works	59
5. Training	92
6. Ocean Transportion	78
7. Consultant Fee	402
8. Sub-total	5,379
9. Contingency (5%)	269
Total	5,648

11.3. Supporting Facilities for Aids to Navigation

11.3.1 Vessels for Aids to Navigation Services

(1) Rehabilitation of vessels for aids to navigation services

Vessels to be rehabilitated in the Short Term Plan is as follows:

① Buoy Tender 6 vessels

② Aids Tender 19 vessels

③ Inspection Boat 7 vessels

(2) Development of vessels for aids to navigation services

Vessels to be developed in the Short Term Plan is as follows:

① Buoy Tender 3 vessels

② Aids Tender 6 vessels

③ Inspection Boat 10 vessels

(3) Implementation schedule for project of vessels in short term plan

Implementation schedule for the project of vessels is shown in **Table 11.3.1.**

Table 11.3.1. Implementation Schedule for Vessels in Short Term Plan

	Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Sub-total	Total
Rehabilitation	1 Survey Vessel											0	32
	2 Buoy Tender						4 vessels					6	
				2 vessels									
	3 Aids Tender											19	
	(1) Class I						3 vessels						
	(2) Class II			1 vessel									
	(3) Class III						7 vessels						
				6 vessels									
	(4) Class IV						2 vessel						
	4 Inspection Boat											7	
	(1) Class III						3 vessels						
				2 vessels									
	(2) Class IV						1 vessels						
				1 vessel									
Development	1 Buoy Tender						3 vessels					3	19
	2 Aids Tender						4 vessels					6	
				2 vessels									
	3 Inspection Boat			10 vessels								10	

(4) Estimated project cost for vessels

Estimated project cost for vessels to be rehabilitated and developed in the Short Term Plan is shown in **Table 11.3.2**.

Table 11.3.2. Cost Estimation of Vessels to be rehabilitated and developed in Short Term Plan

Unit: Thousand US$

No.	Item	Pahse I	Pahse II	Total
1	Rehabilitation			
	(1) Survey Vessel			0
	(2) Buoy Tender	3,000	1,972	4,972
	(3) Aids Tender	4,140	2,642	6,782
	(4) Inspection Boat	840	828	1,668
	(5) Consulting Fee	159	108	267
	Sub-total of 1	8,139	5,550	13,689
2	Development			
	(1) Buoy Tender	29,076	0	29,076
	(2) Aids Tender	21,080	11,636	32,716
	(3) Inspection Boat	0	21,530	21,530
	(4) Consulting Fee	1,504	994	2,498
	Sub-total of 2	51,660	34,160	85,820
3	Total of 1. & 2.	59,799	39,710	99,509
4	Contingency	2,989	1,985	4,974
	Grand Total	62,788	41,695	104,483

11.3.2. Buoy Base and Workshop

The following locations are selected for the improvement and development project in the Short Term Plan from the Master Plan:

(1) Buoy base to be improved

1) Buoy bases 4 locations

2) Open storage 2 locations

(2) Buoy bases to be developed

1) Buoy bases 6 locations

2) Open storage 10 locations

(3) Workshop to be improved

1) Workshops 7 locations (including BTKP)

2) Open storage 4 locations

(4) Jetty

1) Jetty to be developed 1 location

2) Jetty to be improved 4 locations

Further study must be required for jetty prior to commencement of the project.

(5) Implementation schedule

Implementation schedule for the project of improvement and development of buoy base and workshop in the Short Term Plan is shown in **Table 11.3.3.**

Table 11.3.3. Implementation Schedule for Buoy Base and Workshop Including Associated Facilities

	Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Development	Buoy Base (6)	3									
					3						
	Open Storage (10)	5									
					5						
	Storage (4)	2									
					2						
	Jetty (1)				1						
Improvement	Buoy Base (4)	2									
					2						
	Open Storage (2)				2						
	Workshop (7)	3									
					4						
	Jetty (4)	2									
					2						

(6) Estimated project cost

The estimated cost for the improvement and development of buoy base and workshop is shown in **Table 11.3.4.**

Table 11.3.4. Estimated Cost for Improvement and Development of Buoy Base and Workshop

Unit: Thousand US$

Phase	I	II	Total
A. Equipment supply	3,331	4,006	7,337
B. Civil and housing works	278	378	656
C. Installation works	221	284	505
D. Transportation	89	95	184
Consulting Fee	212	279	491
Total	4,131	5,042	9,173
Fiscal Contingency	207	252	459
Grand Total	4,338	5,294	9,632

11.4. VTS System

11.4.1. General

The project sites for Short Term Plan should be selected among the foresaid seventeen (17) project sites that are specified as project sites for Master Plan of VTS System. The selected project sites are shown in **Table 11.4.1. (1).**

Table 11.4.1. (1). List of Project site for Master Plan

No.	Category of station	Type of station	Q'ty	Name of Project site
1.	Main Center	Main Center	1	Jakarta
2.	Sub Center	Sub Center	2	Sunda and Lombok Strait
3.	Radar and AIS remote station	Remote station	2	Merak, Tanglad
4.	AIS remote station		12	Tanjung Lesung, Surutu, Natuna, Kalukalukuang, Buttu Tuopoang, Buttu Salome, Alor, Romang, Molu, Sulabes, Mayu and Maru.

To select the project sites, the following items were considered deeply:

- Importance of sea area such as entry/exit area of sea lane having many national ships crossing strategic sea lane.
- Prospective and expansible VTS System.
- Usefulness for safe navigation, surveillance of sea lane and especially usefulness as training center for operator of VTS operation.
- Intention of GOI.

11.4.2. Selection of Project Sites

(1) Evaluation of project site status.

The project sites for Short Term Plan are chosen from fourteen (14) remote station sites specified as Master Plan. All project sites of remote station site are evaluated upon some aspects specified as follows:

- Aspect of strategy
- Aspect of navigational hazard
- Aspect of environmental situation
- Aspect of traffic density and patterns
- Aspect of relation with existing VTS
- Aspect of volume of passenger
- Aspect of priority specified by GOI

(2) Project sites for Short Term Plan

Each remote station sites specified in **Table 11.4.1.(1)** was evaluated in aspect of the foresaid items. The priority of each site is derived from evaluation result shown as **Table 11.4.1.(2).**

Table 11.4.1. (2). Result of Evaluation

Level of Priority	Project site	Remarks
1.	Merak	West Jawa
2.	Tanglad	Nusa Pedia Island
3.	Tanjung Lesung	South-west Jawa
4.	Natuna Island	South China Sea
5.	Sarutu Island	Kalimata Strait

Project sites shown in **Table 11.4.1.(2)** were evaluated in aspect of Marine casualty and accessibility to site. As a result, Project sites for Short Term Plan was decided. Project sites for Short Term Plan are shown in **Table 11.4.1.(3).**

Table 11.4.1. (3). Project Sites for Short Term Plan

No.	Name of Project site	Target sea area
1.	Merak	Sunda Strait sea area
2.	Tanglad	Lombok Strait sea area

(3) Project site of Main/Sub Center for Short Term.

Project site for Sub Center should be located in adjacent area of remote station sites that are located at Sunda and Lombok Strait. Therefore we provide Sub Center at suitable position to mange the targeted sea area as follows:

No.	Name of Project site for remote station	Name of Project site for Sub Center
1.	Merak	Sunda Strait (Merak)
2.	Tanglad	Lombok Strait (Benoa)

11.4.3. Project Cost for Short Term Plan.

Project cost is estimated as follows:

Table 11.4.3. (1). Project cost of Short Term Plan

Unit: Thousand US$

Description	Cost of Short Term Plan	
	Foreign	Local
Procurement of equipment	3,667	-
Installation and setup	613	-
Spare parts	94	-
Civil works	164	416
Training	61	-
Engineering	652	-
Sub-total (Direct cost)	5,251	416
Ocean Transportation and packing	105	-
Contingency (5%)	263	21
Grand Total	5,619	437

11.5. GMDSS Expansion and Improvement

11.5.1. General

In order to meet the requirement of SOLAS Convention, the following GMDSS expansion and improvement plans shall be implemented as an urgent project, thereby notified the station list for GMDSS to International Maritime Organization (IMO) after their completion.

11.5.2. Expansion of GMDSS Coverage

(1) Sea Area A2 by MF DSC

The following existing stations should be installed with MF DSC to cover major blind zones..

1st class : 1 station

2nd class : 3 stations

3rd class : 2 stations

4th class : 13 stations

Figure 10.5.1. shows the expansion coverage for Sea Area A2.

(2) Sea Area A1 by VHF DSC

The following existing stations should be installed with VHF DSC to cover around main ports and important navigation waters.

1st class : 1 station

2nd class : 3 stations

3rd class : 5 stations

4th class : 24 stations

Figure 10.5.2. shows the expansion coverage for Sea Area A1.

11.5.3. Introduction of National NAVTEX

The 1st stage of National NAVTEX service in Indonesian language will be commenced using the transmitters and the frequency of the present International NAVTEX stations (Jakarta, Makassar, Ambon and Jayapura).

All the above items are shown in **Table 10.5.2.**

11.5.4. Cost Estimate

Unit: Thousand US$

Expansion of A1 and A2 areas	NAVTEX	Total
22,014	(not required)	22,014

11.6. Indonesia Ship Reporting System

11.6.1 General

Recognizing that SAR Convention recommends the establishment of a Ship Reporting System which greatly contributes to maritime search and rescue and the prevention of marine pollution, and considering that Republic of Indonesia, as a big maritime state in the world, has a vital responsibility for ensuring maritime safety and protecting marine environment, Indonesia Ship Reporting System should be planned and implemented as early as possible.

11.6.2. System Composition

(1) Report Receiving Stations

Report Receiving Stations (Receiving Stations) will be set up at the major coast stations (1st, 2nd and 3rd class).

The Receiving Stations receive reports from participating ships by;

HF DSC/NBDP	: 1st and 2nd class stations
MF DSC/NBDP	: 1st, 2nd and 3rd class stations
VHF AIS	: 1st and 2nd class stations

INMARSAT, e-mail and other public networks

The 3rd class station sends the reports to each Report Sub-Center.

(2) Report Sub-Centers

Report Sub-Centers (Sub-Centers) will be set up at the 1st and the 2nd class coast stations.

Sub-Centers collect reports directly from participating ships or the 3rd class coast stations, and send the data to Ship Reporting Center at Jakarta.

Sub-Centers receive processed data from Ship Reporting Center and send the data to ADPEL and other SAR related organizations as needed.

(3) Ship Reporting Center

Ship Reporting Center (Center) will be set up in Jakarta coast station, Tg. Priok.

Center collects, processes, analyzes and stores various reports received from Sub-Centers or directly from ships through INMARSAT and other public networks.

Center sends the processed data to Sub-Centers, and to DGSC, ARMADA and SAR related organizations as needed.

(4) Network

Telecommunication network for the reports transmission at the 1st stage is as follows;

Center	~	Sub-Centers	: Internet / Existing HF
Sub-Centers	~	3rd class stations	: Existing HF

Figure 10.6.2. and **Table 10.6.1.** show the project sites for INDOSREP at the 1st stage.

11.6.3. Cost Estimate

Unit: Thousand US$

Center	Sub-Center (1st ,2nd class)	3rd class	Total
1,779	9,355	314	11,448

11.7. Replacement and Improvement of Aged Equipment/Facilities

11.7.1. General

DGSC has deployed 221 coast stations throughout Indonesia and owns a number of equipment/facilities.

Many equipment and facilities were modernized by the Maritime Telecommunication System Projects Phase-Ⅰ,Ⅱ and Ⅲ, nevertheless there still remain problems such as aging of equipment/facilities and on environment of radio wave. Most of the problems are serious, then these are to be solved urgently in order to cope with the current maritime telecommunication needs, such as GMDSS.

11.7.2. Improvement of Coast Stations for Enabling them to Cover GMDSS

The following improvement for coast stations should be executed urgently in synchronization with the project of GMDSS expansion:

(1) Separation of transmitting and receiving station
Teluk Bayur (2nd class)
Benoa (3rd class)

(2) Improvement of environment for coast stations
Surabaya (1st class)
Makassar (1st class)

(3) Improvement of VHF coverage
Dumai (1st class)
Samarinda (3rd class)

(4) Improvement of engine-generators
1st and 2nd class stations

(5) Replacement of old antennas
1st and 2nd class stations

11.7.3. Cost Estimate

The cost for replacement and improvement of aged equipment/facilities are estimated as **US$ 17,787,000.**

11.8. Short Term Plans summarized

The Short Term Plans up to year 2007 are also divided into two fields, one is aids to navigation and another is telecommunications system.

The field of aids to navigation consists of four (4) kinds of Master Plans that are "Visual Aids to Navigation", "Radio Aids to Navigation", "Supporting Facilities" and "VTS system", and those project costs are estimated at **US$32.649, 5.648, 114.115** and **6.056 million** respectively. The total estimated cost for aids to navigation field is **US$158.468 million.**

Another field of telecommunications system consists of three (3) kinds of Master Plans that are "GMDSS", "Ship Reporting System" and "Telecommunications System", and those project costs are estimated at **US$22.014, 11.448** and **17.787 million** respectively. The total estimated cost for telecommunications system field is **US$51.249 million.**

The grand total of estimated project costs for the **Short Term Plans** is **US$209.717 million.**

The Master Plans summarized with implementation schedule and estimated project costs are shown in **Table 11.8.1.**

Table 11.8.1. Implementation Schedule and Cost for Short Term Plans

Unit: Million US$

Items			2002	2003	2004	2005	2006	2007	Cost (Million.US$)	
Aids to Navigation	Visual Aids to Navigation	Rehabilitation and Improvement (Light House:35, Light Beacon:176, Light Bouy:61)							32.649	
		New Development (Light House :18, Light Beacon:61, Light Buoy:125)								
	Radio Aids to Navigation	New Development (DGPS Station:3, Monitoring Center:1)							5.648	
	Supporting Facilities	Vessels: Development 19, Rehabilitation 32							104.483	114.115
		Development (Improvement) Buoy Bases:6(4), Open Strage:10(2), Workshop:0(7), Storage 4(0), Jetty:1(4)							9.632	
	VTS System	New Development（Sub Center:2)							6.056	
				Aids to Navigation Total Cost					158.468	
Items			2002	2003	2004	2005	2006	2007	Cost (Million.US$)	
Telecommunications System	GMDSS	Installation of MF DSC for Sea Area A2（19）							22.014	22.014
		Installation of VHF DSC for Sea Area A1 (33)								
		Installation of National NAVTEX（4）							0.000	
	Ship Reporting System	Installation of Report Receiving Stations in existing Coast Stations（74）							0.314	11.448
		Installation of Report Sub-Centers（18）in existing Coast Stations							9.355	
		Installation of Ship Reporting Center in Jakarta Coast Station（1)							1.779	
	Telecomm. System	Replacement and Improvement of aged Equipment and Facilities							17.787	
				Telecommunications System Sub Total					51.249	
				Short Term Plans Total Cost (including proposed priority project)					209.717	

Implementation without Cost

Implementation with Cost

CHAPTER 12.
FEASIBILITY STUDY ON PROPOSED PRIORITY PROJECTS

The Study Team selected the five (5) urgent projects from the Short Term Plans up to year 2007 as Proposed Priority Projects. The feasibility study for each Proposed Priority Project was implemented and the study reports were bound in separate five (5) volumes attached. Finally, the Study Team made a recommendation as Recommendable Priority Projects as stated in Chapter 14 after evaluation.

12.1. Visual Aids to Navigation including Supporting Facilities

12.1.1. Visual Aids to Navigation

The project sites of Short Term Plans are selected from the Master Plans.
And, the important sites are selected again from the Short Term Plans as Proposed Priority Projects.

Table 12.1.1. Total Number of Visual Aids to Navigation in Proposed Priority Projects

	Development	Rehabilitation and improvement
Lighthouse	8 units	21 units
Light beacons	33 units	131 units
Light buoy	34 units	61 units

(1) Rehabilitation and Improvement Plan

Lighthouses and Light beacons to be rehabilitated or improved as Proposed Priority Project are decided considering the following aspects in Short Term Plan:

- Out of services,
- Collapse of structure,
- Complex damage (Lantern, Power supply and Structure).

(2) Development Plan

For lighthouses and light beacons, the following aspects in Short Term Plan are to be considered in the Proposed Priority Projects:

- Entrance and exit sea lane and Turning point on sea lane,
- Traffic route,
- Dangers on route,
- Marine casualty,.

(3) Implementation schedule

Implementation of Proposed Priority Projects is scheduled as the following **Table 12.1.2.**

Table 12.1.2. Implementation schedule

	Type of VATN	Phase	Unit	Master Plan						
				01	02	03	04	05	06	07
Rehabili - tation	Lighthouse	Phase1	21							
	Light Bacon	Phase1	131							
	Light Buoy	Phase1	61							
Develop - ment	Lighthouse	Phase1	8							
	Light Bacon	Phase1	33							
	Light Buoy	Phase1	34							

(4) Cost Estimate

The cost required for Proposed Priority Projects of visual aids to navigation is shown in **Table 12.1.3.**

There included the cost of rehabilitation for visual aids to navigation.

Table 12.1.3. Total Project Cost for Proposed Priority Project of Visual Aids to Navigation

Unit: Thousand US$

Equipemnt supply	12,955
Civil and houseing works	3,138
Instalation works	1,248
Transportation	433
Consulting Services	1,777
Sub-total	19,551
Contigency (5%)	978
Total	20,529

12.1.2. Supporting Facilities

Supporting facilities comprises workshops and buoy bases for maintenance of visual aids to navigation facilities. Those facilities are very important to maintain the function of visual aids to navigation. Actual condition of these facilities in locations specified in the proposed priority project is too old and there is insufficient working capacity of machine and tools, so the earlier improvement is required.

Table 12.1.4. Proposed Supporting Facilities for Priority Project

Item	Development	Improvement
Buoy Base	3 office: • DISNAV Tanjung Pinang • DISNAV Semarang • DISNAV Benoa	2 office: • DISNAV Tanjung Priok • DISNAV Samarinda
Open Storage	5 office: • DISNAV Belawan • DISNAV Tanjung Pinang • DISNAV Tlk Bayur • DISNAV Palembang • DISNAV Semarang	
Workshop		3 office: • DISNAV Palembang • DISNAV Surabaya • DISNAV Samarinda
Storage		2 office: • DISNAVTanjungPinang • DISNAV Benoa

(1) Implementation schedule for supporting facilities is shown in **Table 12.1.5.**

Table 12.1.5. Implementation Schedule for Supporting Facilities

	Year	Master Plan										
		01	02	03	04	05	06	07	08	09	10	11
Workshops	Phase1			■	■	■	■	■				
Buoy Bases	Phase1			■	■	■	■	■				

(2) Estimated cost

Estimate of project cost for supporting facilities consisting of workshops and buoy bases is shown in **Table 12.1.6**.

Table 12.1.6. Estimated Cost for the Development and Improvement of Workshop and Buoy Base

Unit: Thousand

Phase	I
A. Equipment supply	3,331
B. Civil and housing works	278
C. Installation works	221
D. Transportation	89
Consulting Fee	212
Sub-Total	4,131
Fiscal Contingency	207
Total	4,338

12.1.3. Feasibility Study

The feasibility study report is bound in separate volume as titled "**FEASIBILITY STUDY REPORT: VOLUME I, PART 1: VISUAL AIDS TO NAVIGATION INCLUDING SUPPORTING FACILITIES**".

12.2. DGPS

Establishment of DGPS stations in Indonesia is requested in order to meet international standards as a maritime country based on the Resolution A.815 (19) and A.819 (19) of IMO, which specifies the requirements of operation of radio aids to navigation and performance standards of GPS receivers including DGPS function respectively.

The only radio aids to navigation in compliance with the requirements of these regulations is DGPS. And, DGPS will become the infrastructure of AIS that will be introduced in 2002.

The locations of three (3) DGPS stations for proposed priority project are shown in **Table 12.2.1.**

Table 12.2.1. Locations of DGPS Transmitting Stations

Station site	Coastal radio station	Latitude	Longitude
Jakarta	Jakarta TX station	06 ° 07' 08"S	106 ° 51' 47"E
Benoa	Benoa TX station	08 ° 44' 35"S	115 ° 12' 32"E
Makassar	Makassar TX station	05 ° 06' 22"S	119 ° 26' 31"E

Project Cost is estimated as follows;

Table 12.2.2. Project Cost for Proposed Priority Project

Unit: Thousand US$

Phase / Description	I
1. Procurement Cost	3,879
2. Installation and setup	404
3. Spare Parts	465
4. Civil and Housing Works	59
5. Training	92
6. Ocean Transportion	78
7. Consultant Fee	402
8. Sub-total	5,379
9. Contingency (5%)	269
Total	5,648

The feasibility study report is bound in separate volume as titled "FEASIBILITY STUDY REPORT: VOLUME II PART 2: DIFFERENTIAL GLOBAL POSITIONING SYSTEM (DGPS)".

12.3. VTS System

12.3.1. General

The priority project should be selected from Project sites for Short Term Plan. Feasibility Study is carried out for Priority project to complete Preliminary engineering design and Cost estimation on result of Feasibility Study work.

Table 12.3.1. Name of Project site for Short Term Plan

Name of Project site		Remarks
For Sub Center site	For Remote station site	
Sunda Strait	Merak	
Lombok Strait	Tanglad	

12.3.2. Proposed sites for Priority Project

VTS System is comprised of Remote station (Radar and/or AIS equipped) and Sub Center. Project sites are proposed as listed in **Table 12.3.1** for Priority project sites. Causes of selection are as follows:.

① In case of Sunda Strait::

- A lot of cargo is transported by ferry from Sumatra to Jawa Island and vice versa.
- There is a congested marine traffic sea area.
- Marine resorts are concentrated along seashore of Sunda Strait.
- Chemical plants and Electric power plants are concentrated along seashore of Sunda Strait

② In case of Lombok Strait::

- A lot of marine resorts and leisure centers are concentrated along Lombok Strait.
- Foreign tourists come to Bali and Lombok Island from many countries, so that environmental condition should be protected for economical benefit from pollution caused by marine casualties.

Actual position of remote stations and Sub Centers will be proposed after the completion of the following Feasibility Study work.

12.3.3. Project Cost for Priority Project

Project cost is estimated as follows:

Table 12.3.2. Project cost of Priority Project

Unit: Thousand US$

Description	Cost of Priority project	
	Foreign	Local
Total cost	5,619	437

12.3.4. Feasibility Study Report

The feasibility study report is bounded in separate volume as titled "**FEASIBILITY STUDY REPORT: VOLUME III, PART 3: VESSEL TRAFFIC SERVICES(VTS) SYSTEM**".

12.4. GMDSS Expansion and Improvement

(1) GMDSS was developed by IMO, and put into service in February 1992 and fully implemented in February 1999. As for the shore-based facilities, Amendments to the 1974 SOLAS Convention, Chapter Ⅳ (Radio communications), Part B (Undertaking by Contracting Governments), Regulation 5 (Provision of radio Communication service) requires Contracting Governments to undertake to make appropriate shore-based facilities for GMDSS.

(2) Accordingly, so far DGSC has installed HF DSC for Sea Area A3 at 12 coast stations and MF DSC for Sea Area A2 / VHF DSC for Sea Area A1 at 30 coast stations, and International NAVTEX transmitters at 4 stations.
However, there still remain many blind waters for Sea Area A2 and Sea Area A1, and National NAVTEX service has not been established yet in Indonesia.

(3) A lot of human lives have been lost every year in Indonesian waters by serious marine accidents.
In many accident cases, the lack of maritime telecommunication system is pointed out. Therefore, the probability of lives to be rescued will be much higher after the completion of GMDSS.

(4) Today, the countermeasures against piracy and armed robbery are the urgent issue for the coastal waters of Indonesia.
IMO recommends all ship masters that if they are or may be subject to piracy and armed robbery, they should quickly report the fact to the nearest Rescue Coordination Center (RCC) or coast station.
GMDSS is an effective means in piracy report from ship's master to a nearby RCC or coast station.

(5) A lot of domestic and international vessels are engaged in transportations and fishing activities in Indonesian waters.
GMDSS provides many favorable effects and impacts on Indonesian social and economic activities by securing maritime safety and preventing marine environment.

(6) GMDSS was developed with the aim that a distress vessel in any sea area can make a quick and secure request for rescue to maritime SAR authorities. Therefore in principle, the whole Indonesian waters should be covered by GMDSS.
However, as Indonesia shall hasten to establish GMDSS shore-based facilities and notify the coast stations list of GMDSS to IMO, the following GMDSS

expansion and improvement should be implemented as an urgent project;

- To cover major blind waters by MF DSC for Sea Are A2,
- To cover waters in and around main ports and important navigation waters by VHF DSC for Sea Area A1,
- To commence National NAVTEX service using a frequency and transmitters for International NAVTEX.
- To improve coast stations having problems for enabling them to cover GMDSS

(7) Budget from Light Dues has been allotted to DGSC from 2001, thereby the maintenance and training fee for the maritime telecommunication system have been substantially increased and the maintenance conditions will be greatly improved hereafter.

(8) Implementation costs for the expansion and improvement of GMDSS are estimated as the amounts in **Table 12.4.1.**

Table 12.4.1. Implementation Costs for GMDSS Expansion and Improvement

Unit: Thousand US$

Expansion of A1 and A2 areas	NAVTEX	Improvement of Coast Stations	Total
22,014	(not required)	17,787	39,801

(9) The feasibility study report is bounded in separate volume as titled "**FEASIBILITY STUDY REPORT: VOLUME Ⅳ, PART 4: GLOBAL MARITIME DISTRESS AND SAFETY SYSTEM (GMDSS)**".

12.5. Indonesia Ship Reporting System

(1) A Ship Reporting System plays an important role in maritime search and rescue in conjunction with distress and safety communication system by GMDSS.

SAR Convention which has become effective since 1985 recommends a contracting Government to establish a ship reporting system for application within its search and rescue region.

(2) In Asia-Pacific region, many systems have been established and operated, such as AMVER (United States), AUSREP (Australia), JASREP (Japan), INSPIRES (India), STRAITREP (The Strait of Malacca and Singapore), KOSREP (Korea) and CHISREP (China), and these have greatly contributed to maritime safety, specially in the sea areas of less rescue forces.

(3) Ship reporting systems are in these days used to provide data for many purposes, not only for search and rescue but also for preventing marine pollution, countermeasures against crimes at sea, etc.

After the simultaneous multi-terrorism in the Unite States on 11 September 2001, Japanese Government is encouraging expanded ship reporting, considering that there will be threats to ships such as terrorism and piracies hereafter.

(4) In the Strait of Malacca and Singapore and Indonesian archipelagic sea lanes, there are many transiting vessels for international transportation, and many passenger and cargo vessels for coastal and inter-island shipping. This means Indonesian waters are in good surroundings to give and get mutual assistances by navigating vessels.

(5) The Republic of Indonesia, as a big maritime state in the world, has a vital responsibility for maritime SAR operation and preventing marine pollution, but vessels for SAR operation are extremely insufficient in quantity and quality.

Therefore, in many cases of marine accidents, SAR authorities have to request for assistance to nearby navigating vessels.

(6) A lot of human lives have been lost every year in Indonesian waters by serious marine accidents.

A Ship Reporting System gives a quick and maximum assistance to a ship in distress and contributes to the decrease of victims at sea.

As Indonesian waters have moderate temperature and calm sea, persons in waters can live longer. Therefore, the introduction of a Ship Reporting System may greatly contribute to the rescue of persons in distress.

(7) As DGSC owns many coast stations throughout Indonesia, Indonesia Ship Reporting System can be established with less cost and short term using these existing coast stations.

At the first stage,

- Existing DSC/NBDP at major coast stations (1st, 2nd and 3rd class) should be utilized.
- In addition, Automatic Identification System (AIS) using VHF which will be installed on vessels from 2002 should be introduced at the 1st and 2nd class stations in order to adopt an automatic position-detecting system.

(8) Budget from the Light Due has been allotted to DGSC from 2001, thereby the maintenance and training fee for the maritime telecommunication system have been substantially increased and the maintenance conditions will be greatly improved hereafter.

(9) Implementation costs for establishment of INDOSREP are estimated as shown in **Table 12.5.1.**

Table 12.5.1. Implementation Costs for Ship Reporting System

Unit: Thousand US$

Center	Sub-Center (1st ,2nd class)	3rd class	Total
1,779	9,355	314	11,448

(10) The feasibility study report is bounded in separate volume as titled "**FEASIBILITY STUDY REPORT: VOLUME Ⅴ, PART 5: INDONESIA SHIP REPORTING SYSTEM**".

12.6. Proposed Priority Projects summarized

The five (5) Priority Projects selected from the Short Term Plans are proposed by the Study Team.

The Priority Projects for the field of aids to navigation are three (3) kinds of projects that are "**Visual Aids to Navigation**", "**Radio Aids to Navigation (DGPS)**" and "**VTS system**", and those project costs are estimated at **US$ 24.867, 5.648** and **6.056 million** respectively. The total estimated cost for aids to navigation field is **US$ 36.571 million.**

Other Priority Projects for the field of telecommunications system are two (2) kinds of projects that are "**GMDSS**" and "**Ship Reporting System**", and those project costs are estimated at **US $39.801** and **11.448 million** respectively. The total estimated cost for telecommunications system field is **US$ 51.249 million.**

The grand total of estimated costs for proposed priority projects is **US$87.820 million.**

The proposed Priority Projects summarized with implementation schedule and estimated project costs are shown in **Table 12.6.1.**

Table 12.6.1. Implementation Schedule and Cost for Proposed Priority Projects

Unit: Million US$

Items			2002	2003	2004	2005	2006	2007	Cost (Million.US$)	
Aids to Navigation	Visual Aids to Navigation including Supporting Facilities	Rehabilitation and Improvement (Light House:21, Light Beacon:131, Light Bouy:61)							20.529	24.867
		New Development (Light House :8, Light Beacon:33, Light Buoy:34)								
		Improvement (Buoy Bases 5, Workshop:3)							4.338	
	Radio Aids to Navigation	New Development (DGPS Station:3, Monitoring Center:1)							5.648	
	VTS System	New Development (Sub Center:2)							6.056	
				Aids to Navigation Total Cost					36.571	
Items			2002	2003	2004	2005	2006	2007	Cost (Million.US$)	
Telecommunications System	GMDSS	Installation of MF DSC for Sea Area A2 (19)							22.014	39.801
		Installation of VHF DSC for Sea Area A1 (33)								
		Installation of National NAVTEX (4)							0.000	
		Improvement of Aged Equipment							17.787	
	Ship Reporting System	Installation of Report Receiving Stations in existing Coast Stations (49)							0.314	11.448
		Installation of Report Sub-Centers (18) in existing Coast Stations							9.355	
		Installation of Ship Reporting Center in Jakarta Coast Station (1)							1.779	
				Telecommunications System Sub Total					51.249	
				Proposed Priority Project Total Cost					87.820	

Implementation without Cost

Implementation with Cost

CHAPTER 13.
ENVIRONMENTAL ASSESSMENT

13.1. Background and Objectives

DGSC is responsible for the environmental conservation on the execution of the Development Plan.

The objectives of this environmental study are to provide the results of the investigation of environmental conservation measures.

The environmental study was conducted based on the relevant laws, regulations and procedures of Indonesia.

13.2. Legal and Administrative Requirement

(1) Legal basis of environmental conservation

In 1997, the Act of the Management of the Living Environment (Act No.23 of 1997) was established.

The Act No.23 of 1997 makes the principle of environmental management clear and serves as a basic indicator for other related legislation.

(2) Decree of the Minister of Communication No. KM4 and KM5 1996

Decree of the Minister of Communication No.KM4 1996, stipulates the compulsion for the completion of Environmental Management Effort (UKL) and Environmental Monitoring Effort (UPL) for the business plan or activity related to Sea Communication Sub-sector, and No.KM5 1996 stipulates the technical manual for implementation of UKL and UPL.

13.3. Project Description

13.3.1 Master Plans

Brief descriptions of the Master Plans on the Aids to Navigation and the Telecommunications System up to the target year of 2020 are as follows;

(1) Visual Aids to Navigation

① Development of Visual Aids to Navigation

② Rehabilitation of Visual Aids to Navigation

(2) Radio Aids to Navigation

① Radio beacon

② DGPS

(3) VTS System

① Straits of Malacca and Singapore

② Sea Lane Ⅰ

③ Sea Lane Ⅱ

④ Sea Lane Ⅲ

(4) Supporting Facilities for Aids to Navigation

① Buoy Tender, Aids Tender, Inspection Boat, Survey Vessel

② Improvement of Buoy Base, maintenance facilities and equipments

(5) GMDSS Expansion and Improvement

① Expansion of GMDSS areas

② Improvement of Coastal Radio Stations for enabling to cover GMDSS

(6) Maritime Telecommunication Networks

① Establishment of Ship Reporting System

② Up-grading of Internal Telecom System

③ Utilization of Satellite System as Internal Communication

④ Integration of Coastal Radio Station

⑤ Up-grading of DGSC Ship's Communication

(7) Improvement of aged equipments and facilities

13.3.2. Projects for investigation of UKL and UPL

Brief descriptions of the 6 sites for investigation of UKL and UPL selected from the Priority Projects are as follows;

(1) Light House Sites

① P. Timau

② Tg. Sading

③ Memburit

④ P. Menjangan

Area :	5000 ㎡ with fencing
Housing :	Living quarters for 5 families, and Powerhouse Equipment
Light tower :	40m above ground level
Lighting equipment :	Rotating type lantern with controller
Power supply system:	For the lighting equipment Solar system
	For the living quarters Engine generator

(2) VTS System Radar sites

① Merak

② Tanglad

Tower height	20m
Leveling of site	1,200m^2
Equipment and Electric generator house	105m^2

13.4. Screening

The screening was conducted for the Master Plans on the Aids to Navigation and the Telecommunications System up to the target year of 2020.

Results are as follows;

(1) According to the Indonesian environmental regulations, it is natural that environmental regulations for harbor construction project are applied correspondingly to our environmental study.

(2) In the "Decree of the Minister of Communication No.KM4 and No.KM5 Year 1996", it is mentioned that environmental study for the middle-scale harbor construction project is the investigation of UKL and UPL.

(3) Middle-scale harbor construction project means, for example, construction project for the berth of 50 to 200 meters of length.

(4) Therefore, IEE shall be conducted based on the above Decrees.

(5) Also, investigation of UKL and UPL on the Priority Projects shall be conducted based on the above Decrees...

13.5. Initial Environmental Examination (IEE)

IEE was conducted on 2 types of project, one of them is the Master Plans, the other is the Priority Projects for the investigation of UKL and UPL selected from the Short Term Plans.

13.5.1. IEE for Master Plans

(1) Selection of Targets

As mentioned above, one of the subjects of IEE are the projects of the Master Plans, listed in 13.3.1. of this Chapter.

However, the following 5 projects are excluded from the targets of IEE because the new construction works are not planned.

① Radio Aids to Navigation
② Supporting Facilities for Aids to Navigation
③ GMDSS Expansion and Improvement
④ Maritime Telecommunication Networks
⑤ Upgrading DGSC Ship's Communication

(2) Target of IEE for the Master Plans

Consequently, it is concluded that the targets of IEE are the following 2 projects:

① Development and Rehabilitation of Visual Aids to Navigation
② Establishment of VTS System

(3) Method

① IEE was conducted based on the natural, environmental and other data and information collected in Indonesia.

② Also, IEE was conducted on the environmental components stipulated in

the above mentioned Decrees.

13.5.2. IEE for Priority Projects

The subjects of IEE for Priority Projects are 4 sites of lighthouse project and 2 sites of VTS project. listed in 13.3.2. of this Chapter.

IEE for the selected 6 sites is conducted with same method and procedure as IEE for the Master Plans.

Details of selection of target sites for investigation are as follows;

(1) Development and Rehabilitation of Visual Aids to Navigation

① Because of rehabilitation of existing facilities, rehabilitation projects were excluded from the target.

② Because of small scale of their civil work, development of Light Beacons and Light Buoys are also excluded from the target.

③ Based on general consideration about the location of each site, and consultation with counterpart, 4 target sites for development of lighthouse out of 13 planned sites of priority projects were selected as target sites for investigation, because it is considered that potential impacts of lighthouse development to the environment are similar and not significant.

④ Environmental assessment on the other 9 planned sites for development of lighthouses was to be presumed based on the results of the investigation of selected 4 target sites.

(2) Establishment of VTS system

Selected both Merak and Tanglad radar sites of the Priority Project.

13.5.3. Summary of IEE

(1) Results of IEE

Results of IEE are summarized as **Table 13.5.1**.

Table 13.5.1. Summary of IEE

	Master Plan	Timau	Sading
1. Land	B	B	B
2. Water	C	C	C
3. Air and noise	C	C	C
4. Flora and fauna	C	C	C
5. Social, economical and cultural component	B	B	B
6. Others	C	C	C

	Memburit	Menjangan	Merak	Tanglad
1. Land	B	B	B	B
2. Water	C	C	C	C
3. Air and noise	C	C	C	C
4. Flora and fauna	C	B	C	C
5. Social, economical and cultural component	B	B	B	B
6. Others	C	C	C	C

Evaluation : A : Significant impact anticipated
B : Not significant impact anticipated
C : Unknown, necessary to investigate
D : No impact anticipated

Not significant impacts on land expropriation and employment opportunity of local people for construction work are anticipated on the Master Plan and 5 selected sites, and not significant impacts on flora and fauna are anticipated on Menjangan site.

(2) Conclusion

Based on the results of IEE on the Master plans and the selected 6 sites of the Priority Projects, it is concluded that the investigation of UKL and UPL on the following 2 projects should be conducted.

① Development of Visual Aids to Navigation
② Establishment of VTS System

13.6 Investigation of UKL and UPL for Priority Projects

The subjects of the investigation of UKL and UPL are 4 sites for development of lighthouse and 2 sites for VTS radar selected from the Priority Projects.

13.6.1 Re-entrustment to Local Consultant

After consulting with counterpart, we selected a local consultant, and re-entrusted the Investigation of UKL and UPL on above six sites of the Priority Projects to them.

13.6.2. Outline of Investigation

(1) Basic concept

The investigation was conducted based on the concept provided in the Decree of the Minister of Communication No.KM4 and KM5 Year 1996.

(2) Survey of present environmental conditions

Data collection, field survey, hearing from community residents and concerned people, laboratory testing and analysis of present environmental conditions consisting of the following components were conducted:

① Land
- a. Geography
- b. Land usage

② Water
- a. Chemical physical quality of water
- b. Bacteriological, plankton, benthos examination

③ Noise
- a. Level of noise

④ Flora and Fauna
- a. Type of flora and fauna, found in sites and surrounding of sites
- b. Natural growth of valuable protected plants

⑤ Social, Economical, Cultural Life
- a. Population
- b Occupation
- c. Culture and health of the society
- b. People's perception
- e. Existence of historical heritage
- f. Existence of national park
- g. Existence of preserve

(3) Study on impacts arising from the planned project

Based on the results of above investigation on present environmental conditions, impacts arising from the planned project were studied.

(4) Establishment of UKL and UPL plans

Based on the results of the above study on environmental impacts arising from the planned project, UKL Plans and UPL Plans were established.

13.6.3. Present environmental conditions

The summarized results of survey conducted for present environmental conditions on the 6 sites are as follows:

(1) Land

① Timau

a. Geography

The site is in Timau Island, about 5m above sea level, 2.3 km^2 and mostly slight slope.

b. Land usage

The island is covered by virgin forest and belongs to local government. There is no inhabitant.

② Sading

a. Geography

The site is located in northern portion of Bintan Island, it is in range of hills, about 10m above sea level.

b. Land usage

There is no inhabitant around the site. This area is owned by Bintan International Resort Co. This area will be used as Bintan International Resort.

③ Memburit

a. Geography

The site is in Membrit Island, it is about 5m above sea level, and mostly slight slope.

b. Land usage

The site is in the middle of dry field used as farmland, owned by local people. There is no inhabitant around the site.

④ Menjangan

a. Geography

The site is in Menjangan Island about 150m above sea level.

b. Land usage

This island is used as Protected Natural Conservation Area and underwater tourism, owned by local government.

There is no inhabitant in the island.

⑤ Merak

a. Geography

The site is in a hilly area about 123m above sea level.

b. Land usage

The site is in hilly and dry field used as farmland, owned by local people. There is no inhabitant around the site.

⑥ Tanglad

a. Geography

The site is in Nusa Penida Island, about 420m above sea level. The contour of the island is mostly steep.

b. Land usage

The site is in the middle of dry field, owned by local people. There is no residence around the site.

(2) Climate

Climatic data were collected at 6 sites

(3) Chemical and Physical component

Following chemical and physical components are observed around the 6 sites, and analyzed in the laboratory.

a. Air quality and noise
b. Soil quality
c. Ground water quality
d. Seawater quality

(4) Biological component

① Flora

There is no protected flora around the 6 sites.

② Fauna

In Menjangan Island, there are protected wild animals, which are Deer, Python Snable, Ular, Pipit, Kutilang and Pupuh.

There is no protected fauna around the other 5 sites.

③ Aquatic biota

a. Coral reef

The surrounding of Menjangan Island is mostly coral reef. They are protected for tourism.

Marked coral colony is not found around the other 5 sites.

b. Fish

Many kinds of tropical fishes are found in Menjangan Island. They are protected for tourism.

No special kind of fish is reported around the other 5 sites.

c. Plankton and Benthos

Plankton and benthos in seawater were analyzed at 6 sites.

(5) Cultural, Social and Economic Component

① Demography

There is no inhabitant around the 6 sites, therefore, it is no need to carryout the resettlement of people.

② Occupation

Majority of people in the district of each site work as farmers and

fishermen with low incomes.

③ Culture of Society

There is a special leadership system in each district.

No historical heritage and sacred place are found around the 6 sites.

a. Timau

Native people of West Bunuran District are Melayu tribe. Majority of people are Moslems, therefore local culture and customs are much influenced by Islamic cultures.

b. sading

Native people of North Bintan district are Melayu tribe. Majority of people are Moslems, therefore local culture and customs are much influenced by Islamic cultures.

c. Memburit

Native people are Madura tribe. Majority of people are Moslems, therefore local culture and customs are much influenced by Islamic cultures.

d. Menjangan

Native people in this district are Bali tribe. The majority of people are Hindu, therefore local culture and customs are much influenced by Hindu cultures.

e. Merak

Native people are Bantenesse tribe. The majority of people are Moslems, therefore local culture and customs are much influenced by Islamic cultures.

f. Tanglad

Native people are Bali tribe. The majority of people are Hindu, therefore local culture and customs are much influenced by Hindu cultures.

④ People's perception

Based on the interview with people of each district at 6 sites, they know the lighthouse, but they have no interest on the construction of lighthouse, however, they expect that they could be recruited to work in the project according to their qualifications.

13.6.4. Summary of Environmental Impacts, UKL and UPL

(1) Summary of environmental impacts

Environmental impacts arising from the planned project at the 6 sites were summarized as **Table 13.6.1.**

Table 13.6.1. Summary of Environmental Impacts

① Timau, Sading, Membrit, Merak and Tanglad

Type of impact	Level of impact	Necessity of UKL/UPL
Air quality	Not significant	No
Noise	ditto	No
Seawater	ditto	No
Flora	ditto	No
Fauna	ditto	No
Land compensation	ditto	Yes
Employment opportunity	ditto	Yes

② Menjangan

Type of impact	Level of impact	Necessity of UKL/UPL
Air quality	Not significant	No
Noise	ditto	No
Seawater	ditto	Yes
Flora	ditto	No
Fauna	Significant	Yes
Land compensation	Not significant	Yes
Employment opportunity	ditto	Yes

(2) Summary of UKL and UPL

The established UKL and UPL are summarized as **Table 13.6.2.**

Table 13.6.2. Summary of UKL and UPL

Site	UKL	UPL
Timau	Land release compensation Employment opportunity	Land release compensation Employment opportunity
Sading	Land release compensation Employment opportunity	Land release compensation Employment opportunity
Membrit	Land release compensation Employment opportunity	Land release compensation Employment opportunity
Menjangan	Seawater quality Fauna Land release compensation Employment opportunities	Seawater quality Fauna Land release compensation Employment opportunities
Merak	Land release compensation Employment opportunity	Land release compensation Employment opportunity
Tanglad	Land release compensation Employment opportunity	Land release compensation Employment opportunity

(3) Conclusion

Based on the results of the investigation, it is concluded as follows;

① Environmental impacts arising from planned 5 sites at Timau, Sading Memburit, Merak and Tanglad on the above mentioned environmental components are classified as not significant.

② However, UKL and UPL on the “Land release compensation” and

"Employment opportunity for local people" should be conducted for the above 5 sites.

③ Environmental impacts arising from planned sites of light house at Menjangan on the above mentioned environmental components except fauna are classified as not significant, but impact on fauna is classified as significant, because Menjangan Island is the natural conservation area, both land and water fauna in this island are protected.

④ Therefore, UKL and UPL on the "Seawater quality", "Fauna", "Land release compensation" and "Employment opportunity for local people" should be conducted for the Menjangan site.

13.6.5. Environmental Assessment on the other planned sites of Lighthouses

Based on the results of the investigation of UKL and UPL on 4 planned sites of Lighthouse, it is considered to be able to assess as follows:

(1) Environmental impacts of the other planned sites

The environmental impacts of the other planned 9 lighthouse development sites of Priority Project might be similar to those of the investigated 4 sites, and also not serious.

(2) Establishment of UKL and UPL Plans

UKL and UPL Plans on the other planned 9 sites might be similar to the investigated 4 sites and then those plans shall be established based on the above 4 investigated site plans.

CHAPTER 14.
RECOMMENDABLE PRIORITY PROJECTS

14.1. Economic Analysis for Proposed Priority Projects

14.1.1. Purpose

To make effective use of limited resource (human resources, commodities, currency), the cost benefit analysis should be implemented quantitatively as far as possible from the viewpoint of effective utilization of resources. The items, which cannot be converted into currency, should be expressed by qualitatively.

14.1.2. Specification of Project

(1) Visual aids to navigation and supporting facilities

① Rehabilitation and improvement of visual aids to navigation.

21 locations of light houses, 131 locations of light beacons and 61 units of light buoys.

② Development of visual aids to navigation and supporting facilities

8 locations of light houses, 33 locations of light beacons and 34 units of light buoys.

(2) DGPS

3 DGPS Stations is established.

(3) VTS System

VTS System in 2 areas (Sunda Straits, Lombok Straits) is established.

(4) GMDSS

It is to install MF DSC for Sea Area A2 at 19 stations and VHF DSC for Sea Area A1 at 33 coast stations, and to commence national NAVTEX service at 4 stations.

(5) Ship Reporting System

It is to establish a ship reporting system; the existing coastal stations (1st class: 9 station, 2nd class 9 stations, 3rd class 31 stations) should be installed with related equipments.

14.1.3. Evaluation Periods of Projects

The evaluation periods of projects should be normally the same as the loan reimbursement periods. In case of ODA loans, loan period is 30 years, grace period of the principal is 10 years.

14.1.4. Approach and Methodology of the Economic Analysis

(1) Visual aids to navigation and supporting facilities

In Indonesian waters, the benefit is the decrease effects of vessel's collisions as a result of the organization of traffic flows. The decreased numbers of collisions

are 9.2 vessels/year in 2007 and 30.5 vessels/year in 2020.

Damage and loss per vessel, which mean benefit per one vessel, are 633,739 USD/ vessel. Economic internal rate of return (EIRR) show 12.0%, therefore this project show good benefit

(2) DGPS (Qualitative Analysis)

The benefits of DGPS are the decrease of Vessel's collisions and that of going aground. Generally they say the accuracy of DGPS is 1 meter and that of GPS is 10meters. According to the measurement of GPS by the study team, the accuracy of GPS was 10.5 meters (95% Cumulative Probability). However, in the range of normal navigation, it is very difficult to evaluate the difference of the accuracy, which has a range between 1meter and 10 meters in normal navigation. Because even if small vessels, master of the vessel expects the error of ships position more than 10 meters. Therefore estimation of quantitative benefits for GPS is almost impossible in the range of this study.

(3) VTS System

In Sunda Strait, the benefit is the decrease effect of vessel's collision as a result of the advice by VTS station to rectify the traffic flow, especially collisions in meeting situation and crossing situation.

The decreased numbers of collisions are 4.6 vessels/year and in 2007 27.1 vessels/year in 2020.

Damage and loss per vessel, which mean benefit per one vessel, are 633,739 USD/ vessel. Economic internal rate of return (EIRR) show 17.3 %. This figure exceeds social discount rate 10%, therefore this project shows good benefit.

(4) GMDSS

Purpose of GMDSS is to establish a distress and safety communication system in Indonesian waters. GMDSS was put into service in February 1992 and was fully implemented in February 1999 according to the regulations under SOLAS Convention and mandatory system for vessels.

① Benefits and costs

By expansion and improvement of GMDSS, benefits and costs are analyzed qualitatively in **Table 14.1.1**.

Table 14.1.1. Benefits and Costs for GMDSS

	Items	Contents	Party concerned
Benefits	・Increasing probability of rescue	・Mainly in Area A1, A2, A3, ships at sea can get reliable transmitting measures for rescue and victims will decrease.	Ship's owner, crew, crew's family, GOI
	・Increasing navigational safety	・Ships at sea can get lots of necessary information systematically, such as weather forecast, navigational information, pirates attack information, etc by national NAVTEX	
	・Decreasing search costs in distress	・Rescue station can know the ship's position in distress early, therefore rescue ship can arrive the scene at the early stage.	GOI
	・Decreasing social unrest due to incorrect news	・By reliable transmitting measures, crew's family will not be influenced by incorrect news.	Crew's family
Costs	・Occurrence of installation costs	・Installation costs for the project occur.	GOI
	・Increasing rescue costs due to mishandling equipments.	・Rescue station order that rescue team go to the scene by incorrect information and increase unnecessary rescue costs.	GOI
	・Occurrence of education and training costs	・Education and training cost occur by installation of new equipments.	Ship's owner, crew, GOI
	・Campaign costs to the public	・Campaign cost to the public occur.	GOI

② "With" case and "Without" case

By expansion and improvement of GMDSS, "With" case and "Without" case for benefits are analyzed qualitatively in **Table 14.1.2**.

Table 14.1.2. "With" Case and "Without" Case for GMDSS

Items	"With" Case	"Without" Case
Probability of rescue	Increasing ・Mainly in Area A1, A2, A3, ships at sea can get reliable transmitting measures for rescue. Probability of rescue will increase and victims will decrease.	No change ・Mainly in Area A1, A2, A3, ships can not get reliable transmitting measures for rescue. Probability of rescue will maintain the present condition.
Navigational safety	Increasing ・Ships at sea can get lots of necessary information in Indonesian language, such as weather forecast, navigational information, pirates attack information, etc, systematically by national NAVTEX. Navigational safety will increase.	No change ・Ships at sea can not get lots of necessary information which mentioned in W/H case systematically. Navigational safety will maintain the present condition.
Search costs in distress	Decreasing ・Rescue station can catch the ship's position in distress early, therefore rescue ship can arrive at the scene early. Search costs in distress will decrease.	No change ・Rescue station may not know the ship's position in distress early, therefore rescue ship have to waste time for searching the ship in distress. Search costs in distress will maintain the present condition.
Social unrest due to incorrect news	Decreasing ・By reliable transmitting measures, crew's family will not be influence by incorrect news. Social unrest due to incorrect news will decrease.	No change ・By unreliable transmitting measure, crew's family will be influenced by incorrect news. Social unrest due to incorrect news will maintain the present conditions.

③ Evaluation of Benefits and costs

Considering **Table 14.1.1** and **Table 14.1.2**, the items are very hard to convert into currency. But it has potential energy for saving human life at sea and for navigational safety. A lot of human lives have been lost every year in Indonesian waters by serious marine accidents. These accidents especially pointed out the lack of maritime telecommunication system. The benefits for decreasing loss of human life and increasing navigational safety are fully worth the projects costs.

(5) Ship Reporting System

The primary reason for the selection of ship reporting system is that International Convention on Maritime Search and Rescue, 1979 (SAR Convention) recommends to establish it.

① Benefits and costs

By development of ship reporting system, benefits and costs are analyzed in **Table 14.1.3**.

Table 14.1.3. Benefits and Costs for Ship Reporting System

	Items	Contents	Party concerned
Benefits	・Increasing probability of rescue	・SAR authorities order the nearby ship to save the ship in distress. By this way, decrease victims. In case of man overboard, SAR authorities order the nearby ship to search the man overboard, victims will decrease.	Ship's owner, crew, crew's family, GOI
	・Increasing navigational safety	・SAR authorities grasp all ships which report to them, in case of stop of reporting, SAR authorities start SAR operation.	
	・Decreasing search costs in distress	・SAR authorities can know the approximate position of ship in distress, therefore rescue ship can arrive the position easily.	GOI
	・Increasing marine environmental protection	・SAR authorities can know ships with dangerous goods in their waters, they can take necessary measures.	GOI
Costs	・Occurrence of installation costs	・Installation costs for the project occur.	GOI
	・Occurrence of education and training costs	・Education and training cost occur by installation of new equipments.	Ship's owner, crew, GOI
	・Campaign costs to the public	・Campaign cost to the public increase.	GOI

② "With" case and "Without" case

By expansion and improvement of Ship Reporting System, benefits are analyzed as "With" case and "Without" case in **Table 14.1.4**.

Table 14.1.4. "With" Case and "Without" Case for Ship Reporting System

Items	"With" Case	"Without" Case
Probability of rescue	Increasing ・SAR authorities order the nearby ship to save the ship in distress, victims will decrease.	No change ・SAR authorities can not specify the nearby ship, therefore they can not order the particular ship to save the ship in distress. Probability of rescue will maintain the present condition.
Navigational safety	Increasing ・SAR authorities grasp all ships which report to them, in case of stop of reporting, they start SAR operation, increase navigational safety.	No change ・SAR authorities can not grasp what ships are in Indonesian waters, therefore ship in distress without no reporting can not expect the rescue operation. Navigational safety will maintain the present condition.
Search costs in distress	Decreasing ・SAR authorities can know the approximate position of ship in distress, therefore rescue ship can arrive at the position easily and decrease search costs.	No change ・SAR authorities may not know the ship's position in distress therefore rescue ship have to waste time for searching the ship in distress. Search costs in distress will maintain the present condition.
Marine environmental protection	Increasing ・SAR authorities can know ships with dangerous goods in their waters, In case of oil spill, they can take necessary measures earlier, marine environmental protection will increase .	No change ・SAR authorities can not know ships with dangerous goods in their waters, In case of oil spill, they can not take necessary measures earlier. Marine environmental protection will maintains the present condition.

③ Evaluation of Benefits and Costs

Considering **Table 14.1.3**, **Table 14.1.4**, the items are very hard to convert into currency. But it has fairly strong effects on saving human life at sea, navigational safety and environmental protection. A lot of human lives have been lost every year in Indonesian waters by serious marine accidents. Ship reporting system contributes to the above effects. The benefits for decreasing loss of human life and increasing navigational safety are fully worth the projects costs.

14.2. Financial Analysis for Proposed Priority Projects

14.2.1. Purpose

The projects under review have expected light dues. From the viewpoint of GOI, feasibility of these projects shall be analyzed.

14.2.2. Current financial situation of GOI

According to the Budgeted Government revenues and Expenditures, Primary balance shows -28,969 Billion Rupiah in 1999/2000, 10,490 Billion Rupiah in 2000, 24,020 Billion Rupiah in 2001. Overall balance shows -83,495 Billion Rupiah in 1999/2000, -44,134 Billion Rupiah in 2000, and -52,529 Billion Rupiah in 2001. Primary balance improves gradually but overall balance is always deficit and domestic financing and foreign financing have covered deficit.

14.2.3. Total amount of investment

Total amount of investment is estimated in **Table14.2.1.**

Table 14.2.1. Total Amount of Investment

Unit: Thousand US$

Items	Foreign Cost	Local Cost	Total
Visual Aids to Navigation including Supporting Facilities	18,034	6,833	24,867
DGPS	5,232	416	5,648
VTS System	5,619	437	6,056
GMDSS	34,632	5,169	39,801
Ship Reporting System	8,994	2,454	11,448
Total	72,511	15,309	87,820

14.2.4. Raising Funds for Investment

Soft loans from foreign banks should be considered for raising funds. The hypothetical terms and conditions the study team has implemented are to use soft loans including ODA loan, and market rate. In this case, ODA loan that is the best terms and conditions among soft loans should be used.

The principal terms and conditions for ODA loan are as follows;

① 15% of total amount of investments should be paid from funds of GOI as a down payment.

② 85% of total amount of investments should be loaned to GOI.

③ Loan period is 30 years, grace period of the principal is 10 years and interest rate is 1.8%.

14.2.5. Calculation for Revenue

Light dues shall be applied to civil works, facilities, machineries, consulting

services and other project needs including operating costs, maintenance costs. Total amount of light dues is shown in **Table 14.2.2**.

Table 14.2.2. Total Amount of Forecasted Light Dues

Unit: US$

	Likeliest Case	Optimistic case	Pessimistic case
2001	13,094,871	13,094,871	13,094,871
2007	21,011,787	23,910,529	18,437,133
2020	48,762,475	69,967,924	33,843,512

14.2.6. Consideration for Financial Internal Rate of Return (FIRR)

To examine the feasibility of each project in ODA loan, consideration for FIRR should be implemented. If GOI implement all projects with 1.8% of FIRR (GDP: Likeliest Case), 23.57% of light dues are needed. It is shown in **Table 14.2.3.**

Table 14.2.3. Summary of Necessary Funds

Unit: Million USD

	Loan	Necessary Funds of GOI	Total Initial Costs	Necessary Light Dues
	1	2	3=1+2	
Visual Aids to Navigation and Supporting Facilities	21.137	3.730	24.867	6.41%
DGPS	4.801	0.847	5.648	1.64%
VTS System	5.147	0.908	6.56	2.03%
GMDSS	33.831	5.970	39.801	10.49%
Ship Reporting System	9.731	1.717	11.448	3.00%
Total	74.648	13.173	87.820	23.57%

14.2.7. Sensitive Analysis

Sensitive analysis in ODA loan should be implemented among three cases. To implement all projects, necessary light dues are 23.57% in likeliest case, 15.72% in optimistic case, and 34.54% in pessimistic case. It is shown in **Table 14.2.4**.

Table 14.2.4. Sensitive Analysis

	Necessary Light Dues		
	Likeliest Case	Optimistic Case	Pessimistic Case
Visual Aids to Navigation including Supporting Facilities	6.41%	4.28%	9.39%
DGPS	1.64%	1.10%	2.41%
VTS System	2.03%	1.36%	2.98%
GMDSS	10.49%	7.00%	15.37%
Ship Reporting System	3.00%	2.00%	4.39%
Total	23.57%	15.72%	34.54%

14.3. Recommendable Priority Projects

14.3.1.Result of Economic and Financial Analysis for Proposed Priority Projects

The results of economic and financial analysis for the **Proposed Priority Projects** are summarized in **Table 14.3.1.**

Table 14.3.1. Result on Economic and Financial Analysis for Proposed Priority Projects

Proposed Priority Projects	Project Cost (Million US$)		Economic Analysis (NA: Not Applicable)		Required % of Light Dues Revenue Prospect to achieve **FIRR 1.8% (ODA Loan)**			Required % of Light Dues Revenue Prospect to achieve **FIRR 6.0% (@Market Interest)**		
	Initial Cost	Operating & Maintenance (30years)	EIRR (30years)	Qualitative Analysis	GDP: Likeliest Case (30years)	GDP: Optimistic Case (30years)	GDP: Pessimistic Case (30years)	GDP: Likeliest Case (30years)	GDP: Optimistic Case (30years)	GDP: Pessimistic Case (30years)
Visual Aids to Navigation with Supporting Facilities	24.867	19.480	12.0%	NA	**6.41%**	4.28%	9.39%	**13.74%**	10.41%	17.74%
DGPS	5.648	6.390	NA	Accuracy of Ship's Position (10m in IMO Resolution)	**1.64%**	1.10%	2.41%	**2.89%**	2.19%	3.78%
VTS System	6.056	8.220	17.3% (16years)	NA	**2.03%**	1.35%	2.98%	**3.96%**	3.00%	5.11%
GMDSS	39.801	30.727	NA	SOLAS Convention	**10.49%**	7.00%	15.37%	**22.82%**	17.29%	29.46%
Ship Reporting System	11.448	9.743	NA	SAR Convention	**3.00%**	2.00%	4.39%	**5.78%**	4.38%	7.46%
Total	**87.820**	**74.561**			**23.57%**	15.72%	34.54%	**49.19%**	37.27%	63.50%
	162.381 Million US $									

14.3.2. Rating of Proposed Priority Projects

(1) **1st Priority Project: GMDSS Expansion**

It is necessary to expand GMDSS for Indonesian waters as the first priority project for the following reasons:

① Introduction of GMDSS started in 1992 in accordance with the SOLAS Convention and to be completed by February 1999.

② DGSC, so far, has equipped 30 coastal radio stations with GMDSS but there still remain a lot of blind waters. It is necessary to cover all the waters of Indonesia.

③ There have still been a lot of big marine accidents due to the poor telecommunication system in Indonesia.

④ It became an urgent task to cope with rampant piracies in Indonesian

waters.

(2) **2nd Priority Project: Development of Visual Aids to Navigation**

It is necessary to implement the priority project plan for visual aids to navigation (including supporting facilities) as the 2nd Priority Project for the following reasons:

① About 20% of visual aids to navigation are in urgent need of rehabilitation in order to achieve 95% availability required by IALA Recommendation and to improve reliability of mariners for aids to navigation.

② As visual aids to navigations are practical facilities that can contribute to the safety of vessels navigating coastal waters, the plan for new construction shall be implemented according to the rating of evaluation.

③ As the Light Dues System has been introduced, the GOI has the responsibility to maintain aids to navigation facilities in good condition and to make a further development for users.

(3) 3rd Priority Project: VTS(Sunda and Lombok) and Ship Reporting System

① VTS System

It is necessary to establish VTS System at Merak for Sunda Strait and at Tanglad for Lombok Strait as the third priority project for the following reasons.

a. Indonesia has been recognized as an archipelagic State by UNCLOS since 1994, and Sea Lanes I, and have been designated as archipelagic sea lanes by IMO since May 1998. It is regulated in UNCLOS that passing-through vessels are not allowed to navigate deviating 25 nautical miles from the either side of the axis lines of the sea lanes, but Indonesia has no systems to monitor movements of vessels at present.

b. VTS ensures the safety of waters and has a role of monitoring navigating vessels in the sea lanes.

c. Merak for Sunda Strait and Tanglad for Lombok Strait are selected for the Priority Project in consideration of the followings:

- Situation of marine accidents around the sea lanes,
- Preparing for the expansion of VTS all over the country in the future, convenient geographical places to access for the education and training of technological knowledge and skill,
- Cargo traffic volume in Sunda Strait and concentration of various kinds of plants around the Strait, and

- Marine resort areas around Lombok Strait.

② Ship Reporting System

It is necessary for Indonesia to introduce the Ship Reporting System in view of maritime safety and marine environment protection in its wide waters for the following reasons:

a. The SAR Convention recommends that each party should establish Ship Reporting System in its Search and Rescue Region (SRR).
b. The system is aiming at fundamental improvement of search and rescue system. The system has remarkably contributed to maritime safety in other countries. Especially in waters of the countries where SAR forces are poor, it has played a great role for the rescue of marine accidents.
c. The reported data can be used for a wide variety of fields such as marine pollution prevention and anti-piracy activities.
d. DGSC vessels engaged in SAR and marine pollution prevention are very poor in quality and quantity. Assistance from many other navigating vessels is necessary.

(4) Postponement of Project Implementation: DGPS

After the abolition of SA (Selective Availability), the accuracy has been improved to some 10 meters, and there are some kinds of GPS receivers that can measure positions with the accuracy of 5 to 9 meters.

According to the results of error measurement carried out from May 2001 to January 2002 in Indonesia, the mean statistic error became 10.5 meters.

Generally, DGPS provides users with higher positioning accuracy of GPS and completeness and reliability of positioning information. When DGPS is combined with AIS and Electronic Nautical Charts to be introduced in the near future, its availability will be further increase.

However at present, the urgency of DGPS has been judged low. Therefore DGPS was put away from the Priority Projects and will be planned from year 2006 within the period of the Short Term Plans.

14.3.3. Economic and Financial Analysis for Recommendable Priority Projects

The Study Team recommends four (4) Priority Projects that are "Visual Aids to Navigation including Supporting Facilities", "VTS at Merak and at Tanglad", "GMDSS Expansion" and "Ship Reporting System".

The summary of economic and financial analysis for the recommendable **Priority Projects** shows in **Table 14.3.2** and **Table 14.3.3**

Table 14.3.2. Result on Economic and Financial Analysis for Recommendable Priority Projects

Proposed Priority Projects	Project Cost (Million US$)		Economic Analysis (NA: Not Applicable)		Required % of Light Dues Revenue Prospect to achieve **FIRR 1.8% (ODA Loan)**			Required % of Light Dues Revenue Prospect to achieve **FIRR 6.0% (@Market Interest)**		
	Initial Cost	Operating & Maintenance (30years)	EIRR (30years)	Qualitative Analysis	GDP: Likeliest Case (30years)	GDP: Optimistic Case (30years)	GDP: Pessimistic Case (30years)	GDP: Likeliest Case (30years)	GDP: Optimistic Case (30years)	GDP: Pessimistic Case (30years)
Visual Aids to Navigation with Supporting Facilities	24.867	19.480	12.01%	NA	**6.41%**	4.28%	9.39%	**13.74%**	10.41%	17.74%
VTS System	6.056	8.220	17.31% (16years)	NA	**2.03%**	1.35%	2.98%	**3.96%**	3.00%	5.11%
GMDSS	39.801	30.727	NA	SOLAS Convention	**10.49%**	7.00%	15.37%	**22.82%**	17.29%	29.46%
Ship Reporting System	11.448	9.743	NA	SAR Convention	**3.00%**	2.00%	4.39%	**5.78%**	4.38%	7.46%
Total	**82.172**	**68.170**			**21.93%**	14.63%	32.13%	**46.30%**	35.08%	59.72%
	150.342 Million US $									

Table 14.3.3. Required Fund Percentage of Light Dues by Recommendable Priority Project in Case of ODA Loan

Unit: Million US$

Priority Projects	Loan	Required Fund of GOI	Total Initial Costs	Required Fund (% of Likeliest Light Due Revenue)
	1	2	3=1+ 2	
Visual Aids to Navigation and Supporting Facilities	21.137	3.730	24.867	6.41%
VTS System	5.148	0.908	6.056	2.03%
GMDSS	33.831	5.970	39.801	10.49%
Ship Reporting System	9.731	1.717	11.448	3.00%
Total	**69.847**	**12.325**	**82.172**	**21.93%**

CHAPTER 15.
RECOMMENDATION OF PROGRAM FOR MANAGEMENT AND MAINTENANCE

15.1. Aids to Navigation System

15.1.1. Problems on Management and Maintenance

The following problems on management and maintenance for aids to navigation were confirmed through the site survey .

(1) Long delay of notification to marinersa

(2) Low availability/reliability of lights

(3) Shortage of spare parts

(4) Limitation of Vessels available for aids to navigation services

(5) Abnormal state of lights

(6) Material for light tower

(7) Complicated responsible area of DISNAVs

(8) Stopped operation of radio aids to navigation

Causes of these problems are mainly,

- Shortage of budget
- Lack of manual,
- Shortage of personnel with technical knowledge and skill,
- Insufficient public relation activities,
- Insufficient communication between offices concerned.

15.1.2. Recommendation on Management and Maintenance

(1) Improvement of budgetary situation

The revenue of light dues is expected to improve the budgetary condition, but it is necessary to make great efforts to obtain the routine budget.

(2) Improvement of management and maintenance system

① Introduction of personal computer (PC) and peripheral equipment in each DISNAV is recommended.

② Reinforcement of public relations activities and introducing light monitoring helper system

③ Maintenance of radio aids to navigation

(3) Reinforcement Buoy bases and workshops

① Workshops and buoy bases

Tools and equipment should be improved.

It is recommended that workshop and buoy base should be located at the same place in order to utilize efficiently and effectively the equipment and

tools for maintenance.:

② Improvement of facilities in Maritime Safety Technology Center (BTKP: Balai Teknologi Keselamatan Pelayaran)

15.2. Telecommunication System

15.2.1. Problems relating to Management and Maintenance

(1) Shortage of budget for management and maintenance

The decrease of management and maintenance budget for years causes many problems.

(2) Shortage of technicians

Some stations have no or few technicians. And the knowledge and skill of many technicians are insufficient.

(3) Lack of leadership

It was found that the leadership of the chief and senior officials of some stations are lacking. The management and maintenance at those stations are not in good order.

(4) Inactive maintenance system

Management and maintenance system have not functioned as a whole including above (1), (2) and (3) at present.

15.2.2. Recommendation for satisfactory management and maintenance

(1) Increase of budget for management and maintenance

Budget from the Light Dues has been allotted to DGSC since 2001.

The maintenance fee for maritime telecommunication system have substantially increased by the Light Dues.

Accordingly, the maintenance condition will be greatly improved hereafter.

It is necessary to make efforts to get more budgets and to make efficient use focusing on important matters.

(2) Sufficient supply of maintenance equipment and facilities.

① Spare parts and spare units
② Measuring and testing equipment, repairing tools
③ Vehicles for maintenance (van-type car and motorbike)
④ Air conditioners for transmitting and receiving stations

(3) Posting of proper supervisors at coast stations

Chief of stations and chief technician/operator should be those with sufficient knowledge, skill and good leadership to carry out operation and maintenance properly.

(4) Increase of training programs

Various training programs are recommended to implement for operators and technicians, especially for young officials.

It is also desired to continue training on management and maintenance by JICA silver experts in the field of maritime telecommunication.

(5) Establishment of Comprehensive Maintenance Function

① Purpose

The purpose is to establish practical and effective maintenance system to cope with recent high-tech equipment and units-type parts.

② Supervisor of the Function

NAVIGASI of DGSC

③ Place to be installed

Jakarta station (Tg. Priok)

④ Major tasks

- Management of budget for Maintenance
- Management of spare parts/units, measuring equipment, repairing tools
- Management of inventory for facilities and equipment of all the stations
- Repairing equipment and units sent from other stations
- Instruction and guidance on technology and repairing
- Management of trouble, repair and training record
- Preparing of Maintenance manual, etc

⑤ Equipment to be provided

- Various types of equipment (for 1st, 2nd, 3rd and 4th stations)
- Various types of measuring instruments
- Various types of repair tools and testing equipment
- Simulators for GMDSS etc
- Spare parts and spare units
- Inventory of facilities and equipment of all the station
- Personal Computers (PC)
- Log of repair
- Maintenance manual

⑥PC Network

Form PC network between Function and 1st / 2nd stations, and utilize for tasks stated in ④.

CHAPTER 16.
RECOMMENDATION OF EDUCATION AND TRAINING

16.1. Preface

Upon planning an education and training system, it is necessary to think about the subject dividing into two categories, namely one based on a long-term view and the other based on a short-term view.

From a long-term view, the system must be planned in consideration of future trends in all thinkable fields ranging from 10 to 20 years to come or probably longer. The movements of the state, its people and the world must be taken into consideration. The change and development of international situations; political, economical, social or technological; should be carefully observed. On the way, there may be sometimes when the orbit must be corrected.

From a short-term view, you should do right away what you can do now. Organized and systematic education and training is ideal but it will take considerable time and budget before it actually starts. Until its start, all what can be done must be done in parallel with the preparation for the above system. Along with utilizing the existing training systems, on the job training (OJT) should take place as often as possible.

16.2. General

16.2.1. Education and Training based on a Long-term View

(1) Measures to take to cope with the New Systems

① Progress of New Technologies

In addition to the traditional technological knowledge and skill, those who are to be engaged in the maintenance of equipment in the new systems in the future will have to learn new technologies.

② Operation and Management

In order to operate and manage the new systems, staff must be internationally oriented. They will have to contact with foreign vessels more frequently than ever, so they have to speak and write English which is well understood by any mariners of any countries.

To meet any situations, they must have knowledge of marine affairs and related international and domestic laws and regulations.

(2) Purpose of Education and Training

The final objective of education and training is to bring up self-reliant mind "do it myself", whether it is personal level or organizational level. Ideally, in the long run, education and training should go systematically and organizationally to develop itself.

16.2.2. Short-term Plan of Education and Training

(1) Utilization of Existing Training Systems

① Domestic Group Training

The training, especially for coastal radio station staff should be resumed as early as possible.

② Overseas Group and Individual Training

The number of those who have participated in overseas group training and other training such as factory training is quite a few compared with the total number of those to be trained, so they should disseminate learned knowledge and skill to their co-workers.

③ Training by JICA Silver Experts at Local Facilities

Some technicians with rich experience at local facilities said this is the most effective type of training.

(2) On-the-Job Training (OJT)

① On the job training such as voluntary training by experienced technicians within facilities should be given as often as possible. Training records should be kept for the improvement of training for the future.

② Excellent technicians should be stationed as many facilities as possible, preferably persons of higher ranks including chiefs who have good leadership. It is also advisable to bring up such kinds of persons.

16.3. Education and Training for the New Systems

GMDSS has already been introduced and operated in Indonesia and to be expanded in the near future. In addition, in this study, other international systems that are new to Indonesia such as Ship Reporting System, VTS and DGPS will be recommended.

In order to properly operate and maintain facilities under these systems, operators and technicians should be well trained and organized. The detail of training will depend on various factors such as size, purpose, organization, operational pattern and specific circumstances of facilities to be established. Therefore at this stage, determinate details about trainees, subjects, period, training place, instructors, etc. cannot be figured out.

However, basic matters common for any kind of similar system can be deduced from experiences of successful systems of other countries and the guidelines mentioned above. Based on these pieces of information, available guidance and/or recommendation can be explained as follows:

16.3.1. GMDSS

(1) Trainees

Operators and technicians of coastal radio stations.

(2) Period of Training

Depends on number and quality of trainees, and type, place and contents of training.

(3) Desirable Type of Training

① Practical training during installation of equipment by manufacturers;

② Training on operation and maintenance after the completion of work by manufacturers;

③ OJT by experienced supervisors and/or high-level technicians;

④ Training by visiting JICA Silver Experts;

⑤ Training at the Training Center in Jakarta.

(4) Contents of Training

① Theoretical knowledge of the System

② Regulations and Documentation

③ Watch keeping and Procedures

④ Practical Training

⑤ Others

The operator should take training of English language, both written and spoken, for the satisfactory exchange of communications relevant to the safety of life at sea.

16.3.2. Ship Reporting System

(1) Trainees

Number and level of trainees will depend on size, type and special circumstances of the facility where ship reporting system is employed. So the details will be determined when these factors become definite.

(2) Period of Training

Depend on the type of training but basically one month will be necessary.

(3) Desirable Types of Training

① Training abroad at similar facilities of the system;

② Training by experts who have rich experience of operating the system;

(4) Contents of Training

The contents of training will depend on what kind of ship reporting system

this country employs and specific circumstances of each facility.

Contents of training special for the ship reporting system are as follows:

① International and National Laws and Regulations relating to ship reporting system;

② Full understanding of Ship Reporting Format based on the standard international ship-reporting format;

③ The Standard Marine Navigational Vocabulary replaced by the Standard Marine Communication Phrases;

④ Indonesian Search and Rescue Region (SRR);

⑤ Information special to the coverage of ship reporting system of the station such as geographic characteristics, vessel traffic situation and weather and sea conditions;

⑥ Interrelationship between ship reporting system and other systems such as VTS;

⑦ Basic knowledge of dangerous goods, harmful substances and marine pollutants;

⑧ Practical operational training, using simulation, if possible.

16.3.3. Vessel Traffic Service (VTS)

Important decision-making will take place in the process of VTS operation. The decision-making will be based on complicated factors such as involved ship's situation, traffic density, and geographic nature of the area and weather and sea conditions. A wrong decision-making might cause a serious accident. Accordingly, the decision-maker must have rich experience in the similar operation endorsed by high-level knowledge and skill.

As for technicians, they must be capable of maintaining new type equipment such as multi-function radars and computers.

(1) Trainees

It is desirable that supervisors and operators will be among personnel coming from Merchant Marine graduate or having experience of operating ships. The number and details of trainees will be decided depending on type, size, purpose, VTS supporting area, etc. of VTS facilities.

Not many technicians will be necessary for the maintenance of the equipment and for supporting operation of VTS but they have to take special training on some sophisticated equipment.

(2) Period of Training

The period will depend on the type of training but training should be given

well in advance of the completion of the VTS.

(3) Desired Type of Training

① Training for Supervisors

Classroom and practical training should be given at VTS facilities abroad, which have long experience of similar operation. This training must be given well before the following training starts. The period for the training will be at least one month.

② Training for Operators

This training will be done in principle on the job. The instructors will be supervisors who have taken training above. They will give training to the staff at their facilities, in classroom and in OJT style practical training.

③ Training by Experts from Abroad

If it is judged that the above training will not be sufficient to carry out the job, experts from abroad with rich experience of operating VTS should visit the facilities and directly give training to the operators.

④ Training of Technicians for Maintenance

In principle, the equipment manufacturers will train technicians before, during and after the construction of facilities at the sites. The training will mainly be in the fields new to them such as radars, computers and Automatic Identification System (AIS). If necessary and possible, they will be sent to foreign countries to take special training on the equipment at factories of manufacturers.

(4) Contents of Training

① Training for Supervisors

a. Knowledge of Marine Affairs

Training should be given on general and broad areas about marine affairs such as nautical charts, aids to navigation, international and domestic maritime organizations, vessel traffic management, dangerous goods and management and control of marine pollution.

b. VTS Equipment

Training should be given on operation of equipment and system and points of maintenance

c. Human Quality

As the supervisor, training should be given on leadership.

d. Countermeasures to Emergencies

Implementation of Countermeasures to Emergencies such as falling overboard, fire, collision, grounding, pollution, spill of poisonous chemicals, piracy and terrorism

e. Planning and Organization

Training should be given on making VTS traffic plans, reporting, internal

and external, and personnel management including training.

f. Knowledge on Legislation

Training should be given on related international and domestic laws and regulations, such as UNCLOS, SOLAS Convention, COLREG 72 and related IMO Guidelines and Resolutions.

g. Proficiency of Standard English (in such level as give training to their staff for sufficiently carrying out VTS services)

② Basic Training for Operators

This Course is planned to give trainees practical training on the roles of VTS.

a. Proficiency in English Language

VTS operators should have proficiency in English in such level as can use nautical charts and other marine publications, understand information on weather and sea conditions and communicate with vessels of VTS coverage. They should also have sufficient knowledge of English to understand technical manuals on basic VTS equipment and to properly operate it.

b. Other Areas

As mentioned above (3) , training will be given by the supervisors on the job basis, so the contents of training will follow suit.

16.3.4. DGPS

DGPS is a new system for Indonesia, and as its nature, GDPS must steadily provide users with highly accurate positioning information for a long time. Therefore, soft components such as management, operation and maintenance are very important. In this connection, training capable persons for the proper management, operation and maintenance will be indispensable.

(1) Trainees

Chief and Senior Technicians of DGPS Managing Group and other Technicians

(2) Period of Training

① Abroad Training for two months

② Domestic Training for one month

③ On-the-job Training for one week

(3) Desirable Type of Training

① Abroad Training for the Chief and Senior Technicians

Most of the existing MFB (Medium Wave Radio Beacon) stations have not been functioning mainly due to poor maintenance and management.

Reflecting on the fact, effective overseas training should be given in a country that has the similar system.

② Domestic Training for Technicians

The training will be given to the technicians who will be the cores for the maintenance and operation of DGPS stations.

③ On the Job Training

④ Transfer of Technology by Experts abroad

(4) Contents of Training

① Abroad Training for the Chief of DGPS Managing Group;

Planning of budget requirements, organization and system, manning and maintenance and operation;

② Abroad Training for Senior Technicians;

Training should be given on new technologies necessary for the system, and maintenance and operation.

③ Domestic Training

The training will be implemented in accordance with "Management Manual", "Maintenance Manual" and "Operation Manual" written by experts.

④ On-the-Job Training (OJT)

One-week practical training should be given at the site upon delivery of the equipment on DGPS Transmitting System and DGPS Monitoring System under the contract with manufacturers.

16.4. Establishment of Integrated Education and Training System

The Education and Training Agency (ETA) was established for the purpose of making education and training in MOC integrated and efficient. The actual services of the Maritime Education and Training Center under ETA at present, however, are mostly for the education and training of seafarers.

Recently, there have been urgent and growing demands for taking measures for search and rescue and against piracies and drug trafficking. In addition, to support maritime safety activities, new international systems such as GMDSS, Ship Reporting System, DGPS and VTS have been developed or planned. Of course, conventional aids to navigation and maritime telecommunication system should be taken into consideration.

In order to meet these demands, it is necessary to establish an integrated education and training system in the field of maritime safety. In order to achieve this, the guidance and assistance of the Education and Training Agency is indispensable. The agencies concerned should cooperate with each other and with the Education and Training Agency to realize it.

For the above purpose, dispatch of experts in the field of maritime safety education and training from developed countries in the field is recommended.

16.5. Summary of Recommendation on Education and Training

16.5.1. General

(1) Establishment of Integrated Education and Training System in the Field of Maritime Safety

(2) Dissemination of Knowledge and Skills obtained from Training

It is the duty for those who have obtained knowledge and skills through international technical cooperation schemes to disseminate them to their staffs and co-workers. It is the very objective of technical cooperation. They can use the opportunities of OJT.

(3) Importance of OJT

OJT should be utilized on every opportunity. Whether OJT is utilized or not will greatly effect on the efficiency of a work place.

(4) Practical Training relating to Construction of Facilities and Installment of Equipment

Practical training before, during and after the construction of facilities and the installment of equipment is very efficient and many people who work for them can participate in the training. Training at manufacturers' factories is also useful. This training should be given well before the completion of the facilities.

(5) Training by JICA Silver Experts on the Site

Training by JICA Silver Experts should be given as often as possible because many people can take training at their work places. This training will be directly applied to their jobs.

(6) Incentive or Motivation

Some kinds of incentive are necessary to activate persons for their job training, personal or in-group. In this connection, qualification/certification system should be considered along with evaluation and promotion system.

16.5.2. Training in general for New Systems

New systems such as Ship Reporting System, VTS and DGPS are to be

introduced in this Study. Other than those in this Study, new systems of international nature will be introduced into this country, sooner or later. Those who are working for coastal radio stations and aids to navigation should prepare for such international trends.

(1) Proficiency of English Language.

Operators under new systems must have good command of spoken and written Standard English. It is indispensable for those who will work for Ship Reporting System and VTS, especially for the latter.

(2) General Knowledge of Maritime Affairs

Not only those who will work for the new systems but also those who are working for coastal radio stations must have general knowledge of maritime affairs such as on ships, oceans, search and rescue, and international and national maritime laws and regulations, preparing for the future movements.

(3) Handling of Personal Computers

Basic knowledge and handling of PC is indispensable for those engaged in the new systems. They have to take every opportunity to learn and practice PC preparing for the new systems and new trend.

16.5.3. Specialized Training for the New Systems

(1) Ship Reporting System

a. Training abroad for senior operators for one month. The number of trainees depends on the detail of the system.

b. OJT for other operators by those who have finished the above training.

(2) VTS

a. Training abroad for Supervisors

The number of trainees will depend on the details to be developed.

The period will be about one month.

Training for Other Staff

In principle, the supervisors above will give training to them on OJT basis at each VTS stations.

b. Training by Experts from abroad

If the above training is not enough, experts from abroad will give training at the sites

c. Simulation Training

Simulation training is especially necessary for VTS operators.

(3) DGPS

a. Two-month abroad training for the Chief of DGPS Managing Group on

management.

b. Two-month abroad training for Senior Technicians on system, and maintenance and operation.

16.5.4. Other Suggestions

(1) Training for ATN Officers in Electronics

For conventional aids to navigation, training for the maintenance of visual aids seems nearly satisfactory but not enough for equipment with electronic systems. The training in this field should be reinforced.

(2) Manual special for each Station

A special manual for each station should be made for operation and maintenance in consideration of specific circumstances of each station. It will greatly help those working for the station carry out operation and maintenance works properly.

(3) Group Training for New Systems

In consideration of the new trends, it is suggested that new course be opened for those engaged in new international systems such as GMDSS, Ship Reporting System, VTS and DGPS.

(4) Reinforcement of Jakarta Training Center

In the overall framework of the Integrated Education and Training System, the Jakarta Training Center should be utilized for training for the new and conventional systems and its functions should be reinforced.

(5) Officer in Charge of Education and Training

An officer in charge of education and training should be placed within DGSC. He/She will act as a counterpart in the field of education and training and as a liaison officer with the Education and Training Agency.

CHAPTER 17.
RECOMMENDATION OF THE MATTERS RELATED TO MARITIME TRAFFIC SAFETY SYSTEM

17.1. Introduction

During the Study period, the Study Team has reviewed / examined all the matters related to Maritime Traffic Safety System in Indonesia and formulated the Master Plans up to year 2020 with their maintenance / educational programs as mentioned before.

However the Study Team has realized through this study that there are many kinds of hardware in Indonesia, of course, some of them are outdated but some of them are updated to be able to utilize the latest technology such as satellite system, high-powered engine and etc. Even updated facilities / equipments, it is questioning whether they are properly operated as initially designed or not.

For example, the modernized supporting vessels like KN "MIZAN" are equipped with full GMDSS and the latest nautical instruments, but for the reason of less budget there are problems that are unable to communicate through satellite system, and some essential nautical instruments need urgent repair and their corroded decks also need maintenance with sufficient tools and paints.

Furthermore, the Search and Rescue (SAR) vessels like the series of GAMAT's "PANAH(Arrow)-201" have almost half of the initial designed speed due to historical poor maintenance for the main reason of insufficient budget, and it becomes very hard to achieve effective SAR activities.

Also, the Jakarta Post dated June 6th 2001 reported that the survivors of the ill-fated KM "Restu Illahi" passenger ship could file a class-action suit against Makassar SAR for the negligence of rescue. For the reference, the passenger ship sunk on May 27, 2001 and there were 49 missing but 44 rescued by fishermen. The Makassar SAR explained the reason of un-dispatch of rescue team that they did not move just because they did not have adequate equipment like fuel and also, accident report was late reaching to them.

On the other hand, in connection with the field of software, the Study Team has also realized that there are many deficiencies in the statistics of the marine casualties prepared by DGSC and historically no activities to confirm the marine traffic density through a sight survey in the sea lanes.

Considering above insufficient condition about the both fields of hardware and software, it became to a conclusion that for the purpose of filling up the deficiencies, the Study Team prepared recommendations in this **Chapter** as the supplements of maritime traffic safety system that are to be realized without investing much money.

17.2. Proposed Traffic Separation Scheme in Sunda Strait

17.2.1. Purpose

The simulation study examine the effectiveness of initial plans, especially establishing of appropriate traffic separation scheme in Sunda Strait, of the Maritime Traffic Safety System in the target years.

17.2.2. Methods of Ship Handling Simulation Study

The real time ship handling simulator is the system to simulate the actual operation of the ship in various conditions and to display the scenery from the navigation bridge visually and audibly on the screen.

17.2.3. Survey Report of Actual Marine Traffic Situation

The survey is to grasp the actual situation of marine traffic of vessels passing Sunda Strait. By 46 hours observation, Total vessels were 346 including 151 car ferries, 95 passenger vessels, 71 cargo vessels, 16 tankers, 5 container vessels and 8 others.

17.2.4. Setting up Conditions

(1) Simulation Area

Simulation area is east and west sides of Sangiang Island.

(2) Model Vessel

The model vessel, which is supposed to be the largest in this area, is VLCC of 280,000DWT class (LOA; 330.0 meters, Lpp; 316.6 meters, Breadth; 60.0 meters, Draft; 10.5 meters in southbound, 20.5 meters in northbound).

(3) Traffic Condition

The present traffic condition refers the maximum passing vessels volume from the survey of actual maritime traffic in Oct. 2001. The traffic volumes in 2007 and 2020 were obtained from Future Interisland and International Calling Vessels Volume of the Final Report.

(4) Natural conditions

Natural conditions were settled as normal conditions (wind direction, ESE 5 meter/second, wind velocity, 5 meters/ second, tide; south, 1.25 knots/hour, visibility; 10 miles, daytime passing).

(5) Simulation Scenario

The simulation scenario consisted of 20 cases. Establishment of TSS (Case Ⅰ and Case Ⅱ) are shown in **Figure 17.2.1.** and **Figure 17.2.2.** respectively.

Figure 17.2.1. Establishment of TSS (Case Ⅰ)

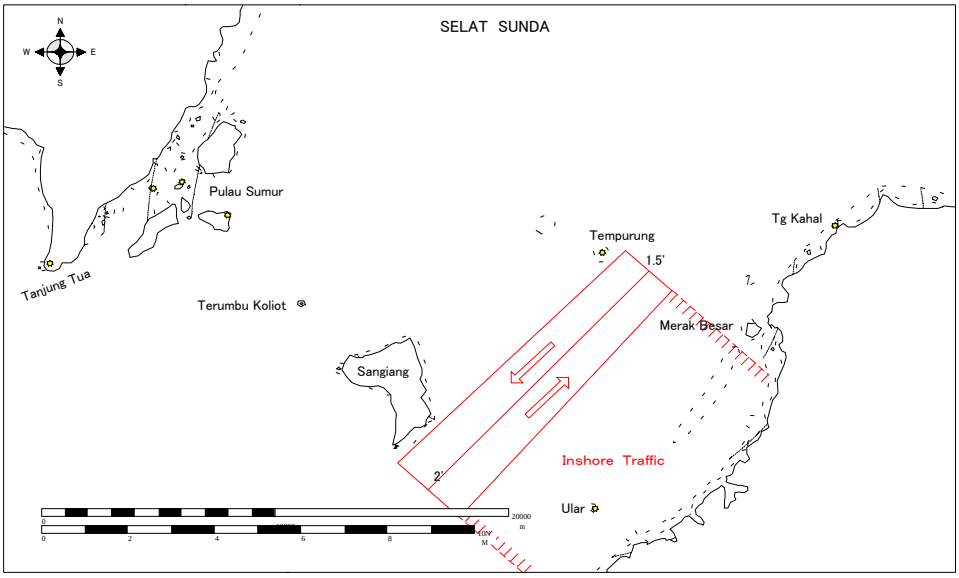
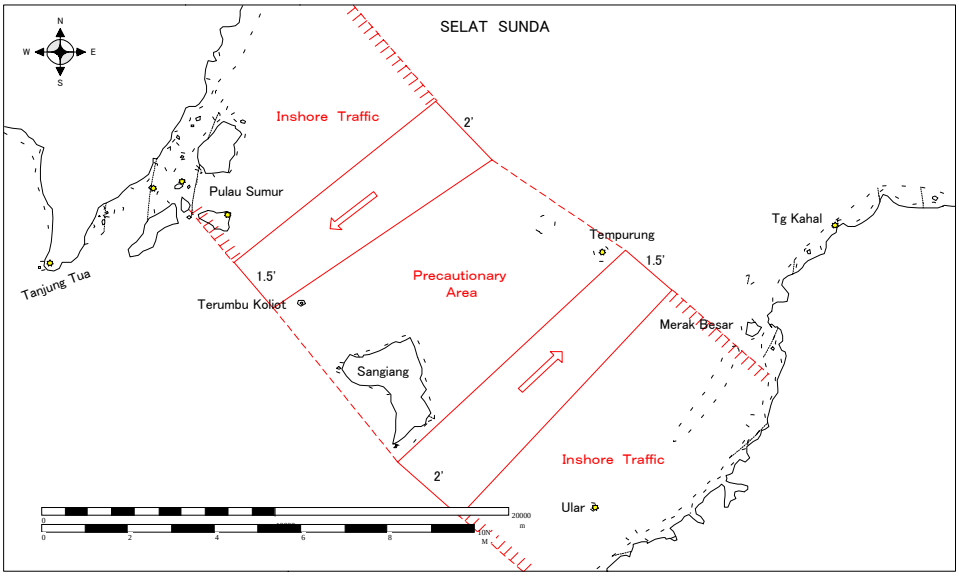


Figure 17.2.2. Establishment of TSS (CaseⅡ)



17.2.5. Rating by Ship Handler

Rating by the ship handler participated in this simulation is done. Rating by the observation of the other participants also is done through questionnaire.

17.2.6. Rating by Blocking Coefficients of Avoiding Action

Blocking coefficient is a numerical factor that expresses the level of restriction (blocking) of collision-avoiding action of own vessel, and it is an index to evaluate the safety of navigation in certain water area quantitatively. Each pattern of scenario is compared relatively by subjective rating of experienced captains and

blocking coefficients. It realize not only subjective but also quantitative ratings for safety of each pattern. Comprehensive study for vessel traffic safety system including establishment of adequate TSS in that water area is implemented with confirmation of the effectiveness of TSS and pointing out existing problems.

17.2.7. Rating by Ship Handler

Rating by the participants in this simulation who have experienced captain and by the observation of the other participants who have experienced captains was done through questionnaire. Their answers were summarized as follows.

(1) Question 1: How do you think if we plan to pass the VLCC (280,000D/W) through the SELAT SUNDA without considring matters?

Answer: Most answers are usual and low risk, however, High risk increased in 2020.

(2) Question 2.: What kind of risk do you feel?

Answer: Largest number of answers is collision followed by grounding.

(3) Question 3: Do you have any idea in order to decrease the above risk?

Answer: Most answers are the settlement of TSS, followed by Vessel Traffic Information Service (VTIS), and Daylight passing.

(4) Question 4: If we plan to set up TSS, where is the best location?

Answer: The majority of answers is TSS-CaseⅡ.

(5) Question 5: If you mind many fishing boats in the waters South of the SANGIANG Island,
How do you feel for passing through east channel with safety?

Answer: They pointed out risks of collision and grounding, recommended TSS Case-Ⅱ, S/B engine, Increase lookout and consider passing through west channel.

(6) Question 6: How do you think this location of TSS? (with TSS)

Answer: The majority of answer is that TSS-CaseⅡis preferable due to width of TSS.

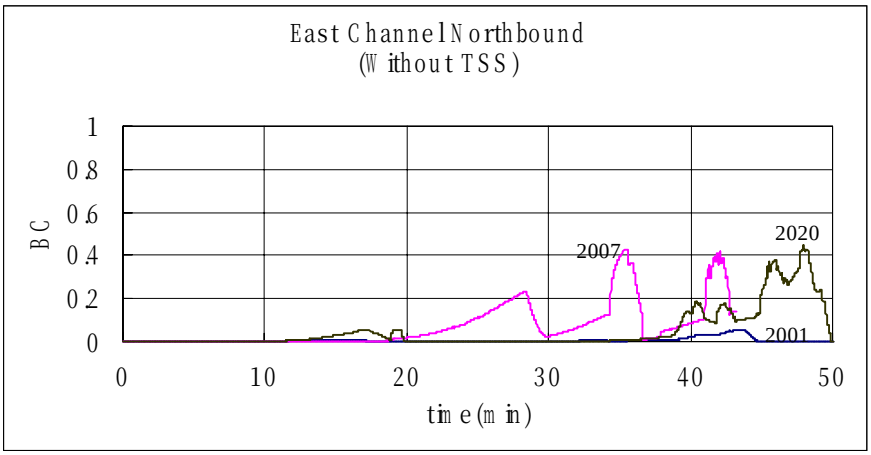
(7) Question 7: Your comment for safe passage, if any.

Answer: In connection with crossing ferry, many answers need to take countermeasure, such as S/B engine, increasing lookouts and information system with crossing ferry. The other majority of answer is that TSS-CaseⅡis preferable due to width of TSS.

17.2.8. Rating by Blocking Coefficients of Avoiding Action

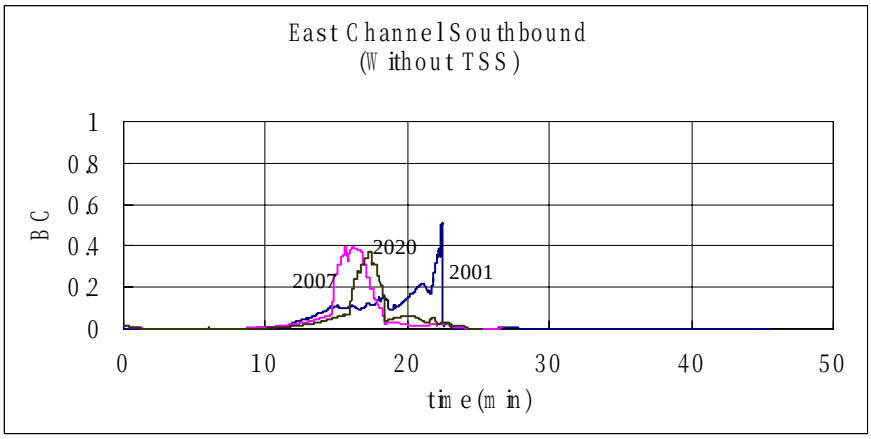
(1) East channel Northbound (**Figure 17.2.3.**)

Figure 17.2.3. East Channel Northbound



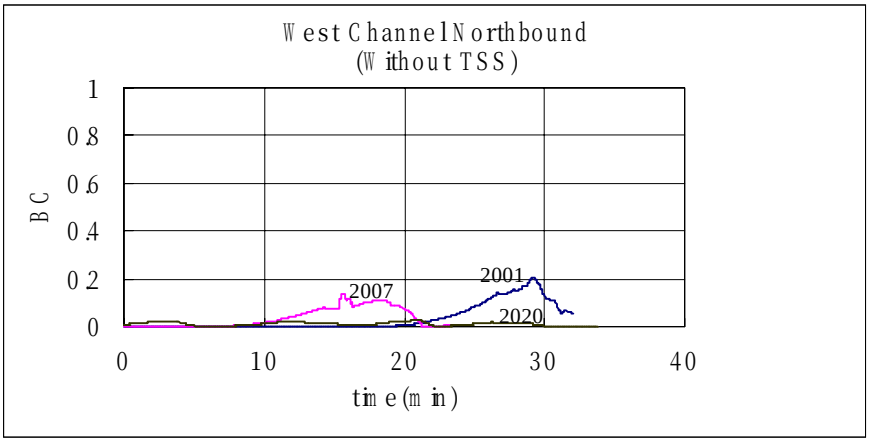
(2) East channel Southbound (**Figure 17.2.4.**)

Figure 17.2.4. East Channel Southbound



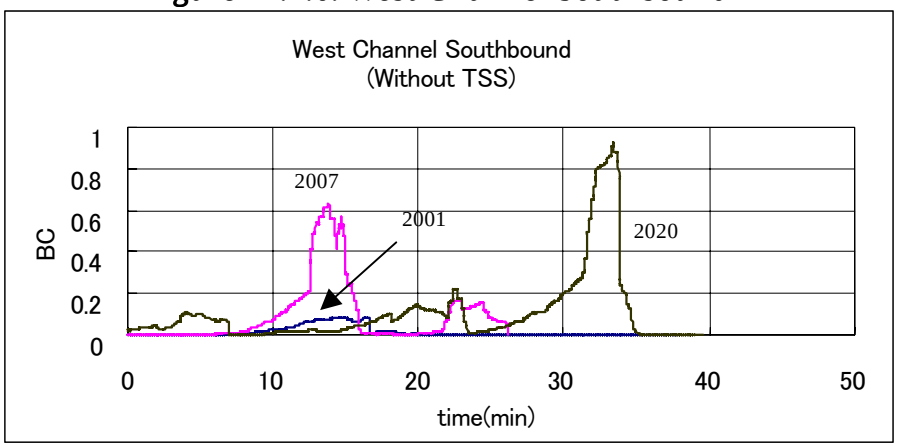
(3) West channel Northbound (**Figure 17.2.5.**)

Figure 17.2.5. West Channel Northbound



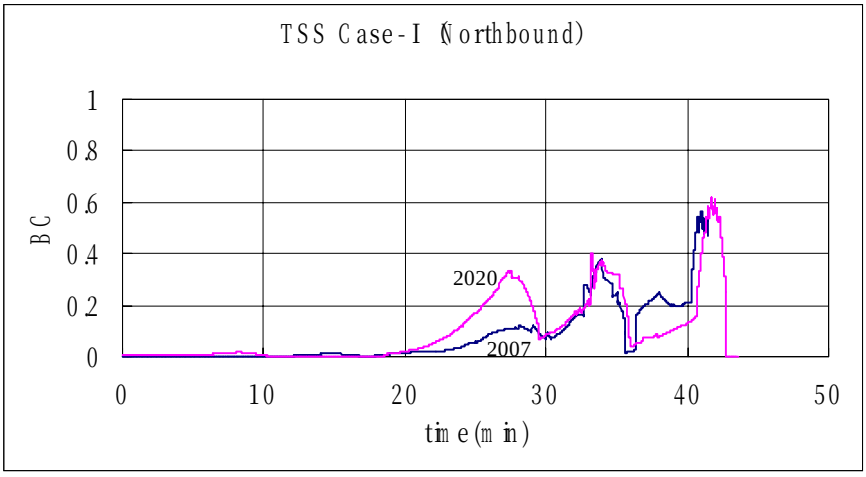
(4) West channel Southbound (**Figure 17.2.6.**)

Figure 17.2.6. West Channel Southbound



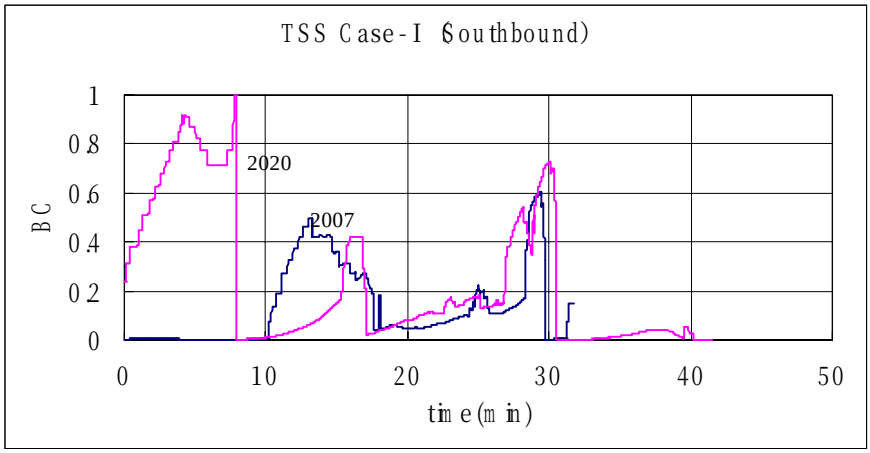
(5) TSS-Ⅰ North bound (**Figure 17.2.7.**)

Figure 17.2.7. TSS-Ⅰ Northbound



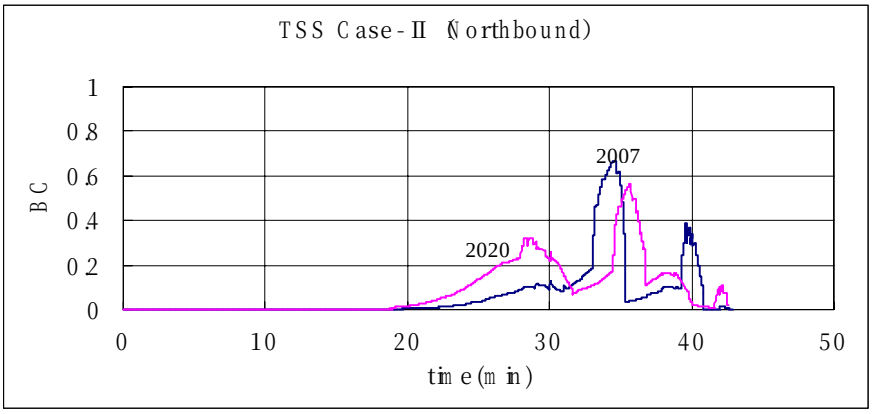
(6) TSS-Ⅰ Southbound (**Figure 17.2.8.**)

Figure 17.2.8. TSS-Ⅰ Southbound



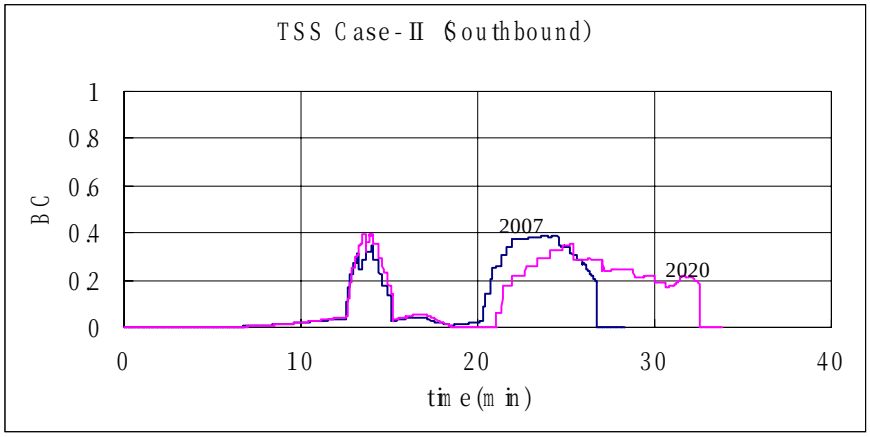
(7) TSS-Ⅱ Northbound (**Figure 17.2.9.**)

Figure 17.2.9. TSS-Ⅱ Northbound



(8) TSS-Ⅱ Southbound (**Figure 17.2.10.**)

Figure 17.2.10. TSS-Ⅱ Southbound



17.2.9. The Evaluation Results of Simulation Experiments

(1) Rating by Captain

① Most captains evaluated that the risk was lower than "Low risk" on the simulated scenarios at present and in 2007, however, their evaluation as "High risk" was drastically increased on it in 2020.

② Most captains suggested that the establishment of TSS is necessary even at present situation. Moreover, they predicted that it would be necessary to take necessary measures for the navigational safety not only as TSS but also VTIS after 2007.

③ All captains felt danger to the crossing ferries and fishing boats.

④ Most captains suggested that TSS would be located at the both sides of the P.SANGIANG Island. Furthermore, the Case II was better than Case I.

(2) Rating by blocking coefficient of avoiding action

① Southbound operation through West Channel without TSS meets the

blocking coefficient of 0.6 in 2007 and 0.9 in 2020.

② The Case I of TSS for the northbound operation meets the blocking coefficient of 0.6 both in 2007 and 2020 and for the southbound operation meets the blocking coefficient of 0.6 in 2007, 0.9 outside of TSS, 0.7 at inside of TSS in2020. Figure 0.9 will happen because of no separation zone.

③ The Case II of TSS for the northbound operation meets the blocking coefficient of 0.65 in 2007, 0.55 in 2020 and for the southbound operation meets it of 0.4 in2007, 0.35 in 2020.

④ Speaking in general, blocking coefficient seems to increase according to increase of traffic quantity, but in some case, it does not always increase. It means that the encounters with other ships do not happen in TSS. The blocking coefficient should be considered not only the extent of figure, but also its duration. Considering above ①,②,③, the advantage to establish caseⅡ of TSS is confirmed.

(3) Overall rating

It is proved by these experiments that the early establishment of TSS is necessary as a safety measure to avoid collision with many crossing vessels and fishing boats, and grounding in such narrow waters. Moreover, it is also judged necessary to establish VTIS in the future. It is suggested that the Case II of TSS is effective as one way traffic on both east and west sides of Sangiang Island, and the width of each separation lane needs at least 1 and 1/4 nautical miles.

17.3. Improvement of Marine Casualty Statistics

17.3.1. Marine Casualty Investigation

In order to consider the measures for preventing marine casualties, it is essential to collect all of necessary data of daily marine accidents and to investigate the causes and to analyze yearly their trends.

To grasp all marine accidents in Indonesia, it is vital to make them clear by only one responsible organization in Indonesia. At the moment the Study Team considers that DGSC should take responsibility to collect daily marine casualty data through various channel of SAR organizations and provide the yearly summary and statistics to concerned parties upon their request.

When collecting daily casualty data, it is necessary to prepare "Marine Casualty Investigation Form" that is standardized among the SAR organizations. An investigation of each marine casualty should be done by this form.

17.3.2. Marine Casualty Statistics

Marine Casualty Statistics that have been annually summarized by DGSC so far, should be also continued to issue with accurate data for grasping the trend of marine casualties and evaluating effects of counter measures for the past marine accidents if any.

The statistics should be annually issued by DGSC after the summarization of all marine casualties. In the statistics, they are necessary to be categorized into kinds of ships, kinds of casualties, areas, nationalities etc. to grasp and analyze the trends of casualties.

17.4. Improvement of Search and Rescue System

17.4.1. Reinforcement of SAR Coordination Function

Maritime SAR activities are performed under the coordinating umbrella of BASARNAS, accordingly SAR coordination function is in BASARNAS. But BASARNAS has a weak point that it has not own power for SAR activities sufficiently, so it is difficult for BASARNAS to command and coordinate the whole SAR powers at the scene of a marine casualty in the present circumstances.

For the implementation of efficient SAR activities, it is desired to reinforce SAR Coordination function and to have closer cooperation among SAR organizations.

17.4.2. Reorganization of SAR System

In order that GAMAT may play the central role of maritime SAR activities, GAMAT Headquarters must manage the movements of patrol vessels of the whole the country and establish central administration system for operation.

17.4.3. Reinforcement of SAR Units

To solve the insufficiency of SAR units, it is necessary to enrich GAMAT powers that play main role of SAR activities. The master plan, “The Study on Maritime Safety Plan concerning Search and Rescue” must be implemented, and conditions of GAMAT powers have to be improved to the powers in the target year of 2005 of the master plan as early as possible.

It is desired specially to deploy large patrol vessels that can respond to a long distance marine casualty and aircraft that have excellent search ability.

And for the improvement of operation ratio of each patrol vessel, it is necessary to establish the system of maintenance, and supply of fuel and repair parts.

17.4.4. Establishment of Cooperation System Among SAR Organizations

The SAR units of GAMAT are not sufficient to carry out SAR activities at present. On the other hand, each of NAVIGASI, the Marine and Aviation Police, the Navy, etc. has considerable number of sea units that can be used for SAR activities. Under these circumstances, it is necessary to establish a cooperation system among them and to perform efficient SAR activities under SAR coordination.

17.5. Periodical Marine Traffic Density Survey in Sea Lanes

Periodical marine traffic density surveys for continuous 48 hours are recommended to carry out at least once a year in major areas of sea lanes in Indonesia.

The result of this survey shall be reflected to establish / improve future various marine traffic systems and it would be useful for drawing a future plan about marine traffic system.

17.5.1. Execution of Marine Traffic Density Survey

(1) Executing Organization

Executing organization of this density survey is recommended to be done by DISNAV vessels and GAMAT Fleet in DGSC.

(2) Entry Form

The entry form of this survey is shown in **Table 17.5.1**. as an example.

(3) Proposed Survey Area

① The Straits of Malacca and Singapore

- Off the north and south coast of Rondo Island in upper Malacca Strait

② Sea Lane I

- Sunda Strait off the north coast of Tempurung Island
- Kalimata Strait off the south coast of Serutu Island

③ Sea Lane II

- Lombok Strait off the east coast of Nusa Penida
- Makassar Strait off the Tanjung Rangas at middle-east of Sulawesi

④ Sea Lane III

- IIIA – Maluku Sea between Mayu Island and Halmahera
- IIIB – Banda Sea off the north coast of Yamdena located at the end of the spur of Sea Lane IIIB
- IIIC – Timor Sea off the northeast coast of East Timur
- IIID – Banda Sea off the east coast of Nusa Tenggara Timur

17.5.2. Marine Traffic Density Survey Report

The results of the marine traffic density survey in each sea lane are to be yearly issued as an official report with proper analysis and comment.

Table 17.5.1. Blank Form of Log Sheet for Marine Traffic Density Survey

Data Log Sheet for Marine Traffic Survey Site Area _____

Serial Number	Date		Local Time	Traffic Route	Ship's Name	Kind of Vessel	Gross Tonnage	LOA (m)	Speed (Kts)	Tow Vessel/ Pusher					Remark (Origin port / Destination)
										LOA Head To Stern	Barges towed or pushed				
											Total No.	Each Gross Tonnage			

Example

1	10	13	0703	S	Nippon	1	10,000	200	10	50					Japan / Persian Gulf
2	10	14	1834	N	Lonbok	3	500	100	12	350	3	30	30	30	Fremantle / Singapore

PART 3

FEASIBILITY STUDY FOR PROPOSED PRIORITY PROJECTS

CHAPTER 18.
AIDS TO NAVIGATION INCLUDING SUPPORTING FACILITIES

18.1. Introduction

To improve the efficiency and productivity of maritime activities, establishment of maritime safety system is indispensable, and so development, improvement, rehabilitation and proper maintenance and operation of aids to navigation (ATN) are required.

There are many countermeasures to prevent marine casualties and to secure maritime safety. The most effective countermeasures are to establish ATN system, and one of the most important and fundamental countermeasures is visual ATN. It will be reduce the possibility of marine casualties.

And also, the proper supporting facilities are required to operate those visual ATN with high reliability and availability.

18.2. Necessity of the Project

(1) Availability of lighted visual ATN

The International Association of Lighthouse Authorities (IALA) recommends that the absolute minimum level of availability should be set at 95% for each light.

The availability of lighted visual ATN operated by each DISNAV/ Sub DISNAV was simply calculated based on the data obtained from April to December 2000.

As a result of simple calculation, the availability of visual lighted ATN operated by DISNAV Sibolga, DISNAV Belawan, DISNAV Tanjung Priok, Sub DISNAV Cilacap, DISNAV Banjarmasin and Sub DISNAV Merauke do not meet the minimum recommendation (95%) of IALA.

The causes reducing availability of lights are mainly theft, collision with ship, collapse, sinking/ drifting, shortage of spare parts due to the limited budget and so forth.

(2) Current operation status of lighted visual ATN

① Lighthouse

35 units of existing lighthouses are required to be rehabilitated or improved.

② Light beacon

194 units of existing light beacons are required to be rehabilitated or improved.

③ Light Buoy

61 units of existing light buoys are required to be rehabilitated or improved.

(3) Current Situation of Supporting Facilities

① Buoy base including open storage

There are nine (9) buoy bases to maintain all buoys in the whole area of Indonesia. On this site survey, the site areas of 2 buoy bases are not sufficient for their work.

② Workshop including storage and jetty

The area of workshop is not sufficient for maintenance work of ATN equipments in several Districts. Tools and machines of workshop are old and deficient.

18.3. Contents of the Project

(1) Visual ATN

Proposed priority project of visual ATN consists of rehabilitation and improvement of existing lights and development of visual ATN.

Total number of visual ATN to be improved and rehabilitated is shown in **Table 18.1.**

Table 18.1. Total Number of ATN to be rehabilitated and improved in proposed Priority Project

Type	Lighthouse	Light beacon	Light buoy
Number of units	21 unit	131units	61units

The calculated sufficiency ratio of lights in Indonesian waters is about 50% and 55% for fixed lights and floating lights respectively, based on total number of existing lighted aids in Indonesia and length of coastal line. Number of ATN is still insufficient in Indonesia.

Total number of visual ATN to be developed is shown in **Table 18.2.**

Table 18.2. Total Number of ATN to be developed in proposed Priority Project

Type	Lighthouse	Light beacon	Light buoy
Number of units	8 unit	33units	34units

(2) Supporting facilities

The supporting facilities to be improved and developed in the proposed priority project is shown in Table 18.3.

Table 18.3. Supporting Facilities to be developed and improved in proposed Priority Project

Item	Development	Improvement
Buoy Base	3 offices	2 offices
Open Storage	5 offices	
Workshop		3 offices
Storage		2 offices

18.4. Concept of the Project

18.4.1 Basic Concept

The proposed Priority Project of Aids to Navigation including Supporting facilities is implemented based on the following basic concept:

- Compliance with International Standards and Indonesian Law
- Establishment of long-term operation
- Securing stable operation of system and easy maintenance
- Minimization of maintenance cost
- Consideration of environmental condition
- Rehabilitation and improvement of existing equipment is the Aids to Navigation System
- Maximal utilization of existing equipments and facilities
- Securing the stable operation and maintenance system
- Light buoy shall be short-tail type in order to utilize effectively the limited space of buoy tender with vertical holding position of buoys.
- Light beacon shall be required to use appropriate material in accordance with the height and the location of installation in consideration of both fabrication cost and installation cost.
- Mooring equipment for buoy shall be the standard length and diameter in order to meet the whole light buoys used now in Indonesia in consideration of sea condition.
- Lantern shall be tough in strength against the wind and wave pressures.
- Power source shall be easy in its maintenance in order to execute the efficient maintenance and operation and will be used by such systems as solar panel and/or other natural energy in order to operate economically.
- Consideration of maintenance free, if applicable
- Consideration of utilizing local product

18.4.2 Design Concept

(1) Visual ATN

① Lighthouse

- Operation and maintenance method: Manned
- Lighting equipment: Main lantern (Rotating type) and emergency lantern (Flashing type)
- Area: 5000 ㎡
- Height of light tower: 40m
- Power source: Solar system for light, Engine generator for living quarters.

② Light beacon

- Operation and maintenance method: Unmanned
- Lighting equipment: Main lantern (Flashing type)

- Area: 400 ㎡ (for land light beacon only)
- Height of light tower: 30m, 20m or 10m depending on service range
- Power source: Solar system

③ Light buoy

- Floating equipment: 2.5m diameters for lateral mark
  3.5m diameter for safe water mark
- Lighting equipment: Flashing type lantern
- Power source: Solar system
- Mooring system: Chain of 32mm diameters for buoy of 2.5mfloat type
  Chain of 38mm diameters for buoy of 3.5mfloat type

④ Light source for the lighting equipment

The light source for each type of lighting equipment is proposed in this plan as shown in **Table 18.4**.

The Light Emitting Diode (LED) is applied for the light source of light beacon 10m and light buoy because of its maintenance free and long lifetime.

Table. 18.4. Light Source of Each Type of Lighting Equipment

Type	Luminous Range	Light source
Lighthouse 40m Main light Emergency light	20 nautical miles at T=0.85 (7,790cd, or over) 18 nautical miles at T=0.85(4,143cd, or over)	Metal haloid, Halogen, or Incandescent lamp Metal haloid, Halogen, or Incandescent lamp
Light beacon 30m	18 nautical miles at T=0.85 (4,143cd, or over)	Metal haloid, Halogen, or Incandescent lamp
Light beacon 20m	15 nautical miles at T=0.85 (2,500cd, or over)	Metal haloid, Halogen, or Incandescent lamp
Light beacon 10m	10 nautical miles at T=0.85 (360cd, or over)	LED
Light buoy (Lateral, etc)	4 nautical miles at T=0.85 (21cd, or over)	LED
Light buoy (Safe Water Mark, etc)	6 nautical miles at T=0.85 (66cd, or over)	LED

⑤ Rehabilitation and improvement of visual ATN

The contents of rehabilitation and improvement are classified into 3 types based on the current status as follows.:

a. Supply of lantern and power source
b. Repairing of structure
c. Replacement of the whole system

(2) Supporting facilities

Criteria for supporting facilities are as given in **Table 18.5**.

Table 18.5. Criteria for Facilities of Workshops and Buoy Bases

Name of Facility	DISNAV I Class I	DISNAV II / Sub DISNAV Class II
Buoy Base	3000 m²	1000 m²
Open storage	200 m²	100 m²
Workshop	1000 m²	600 m²
Storage	1000 m²	500 m²
Workshop Equipment	1 set	1 set

18.5. Result of Feasibility Study in Technical Aspect

18.5.1. Visual ATN

(1) Rehabilitation and improvement of ATN

In case that light beacons are completely replaced, these sites of light beacons are confirmed to be sufficient for construction work and accesses.

(2) Development of ATN

The study is made for visual ATN to be developed. The site survey was executed to confirm the following items:

① Availability of raw construction materials
② Availability of premise
③ Accessibility to site
④ Availability of commercial power source or natural energy
⑤ Availability of man power for construction works
⑥ Condition of surrounding site, ground level, ground water level, seabed substances, topographic condition and feature of soil
⑦ Tentative measurement of land for cost estimation
⑧ Accommodation facilities near the site
⑨ Transportation route and method

As a result of site survey, it is confirmed that all sites are feasible to newly develop visual ATN.

18.5.2. Supporting Facilities

The feasibility study for supporting facilities that consist of workshop and buoy base is made to confirm the following items:

① Area and space of existing facilities
② Availability of premise
③ Availability of commercial power source

As a result of site survey, it is confirmed that all sites are feasible to newly develop visual ATN.

18.6. Investigation of Environmental Management Effort (UKL) and Environmental Monitoring Effort (UPL)

18.6.1. Selection of Target Sites for Investigation

(1) Based on general consideration about the location of each site, and consultation with counterpart, 4 target sites for development of lighthouses out of 8 planned sites of Priority Projects were selected as target sites for investigation, because it is considered that potential impacts of lighthouse development to the environment are similar and not significant.

(2) Environmental assessment on the other 9 planned sites for development of lighthouses was to be presumed based on the results of the investigation of selected 4 target sites.

18.6.2. Summarized Results of the Investigation

The results of the investigation, are summarized as follows;

① Environmental impacts arising from planned sites of light houses at Timau, Sading and Memburit on the above mentioned environmental components are classified as not significant.

② However, UKL and UPL on the "Land release compensation" and "Employment opportunity for local people" should be conducted.

③ Environmental impacts arising from planned sites of light house at Menjangan on the above mentioned environmental components except fauna are classified as not significant, but impact on fauna is classified as significant, because Menjangan Island is the natural conservation area, both land and water fauna in this island are protected.

④ Therefore, UKL and UPL on the "Seawater quality", "Fauna", "Land release compensation" and "Employment opportunity for local people" should be conducted

18.6.3. Environmental Assessment on the other planned sites of Lighthouse

Based on the results of the investigation of UKL and UPL on 4 planned sites of lighthouses, it is considered to be able to assess as follows:

(1) Environmental impacts of the other planned sites

The environmental impacts of the other planned 4 lighthouse development sites of Priority Project might be similar to those of the investigated 4 sites, and also not serious.

(2) Establishment of UKL and UPL Plans

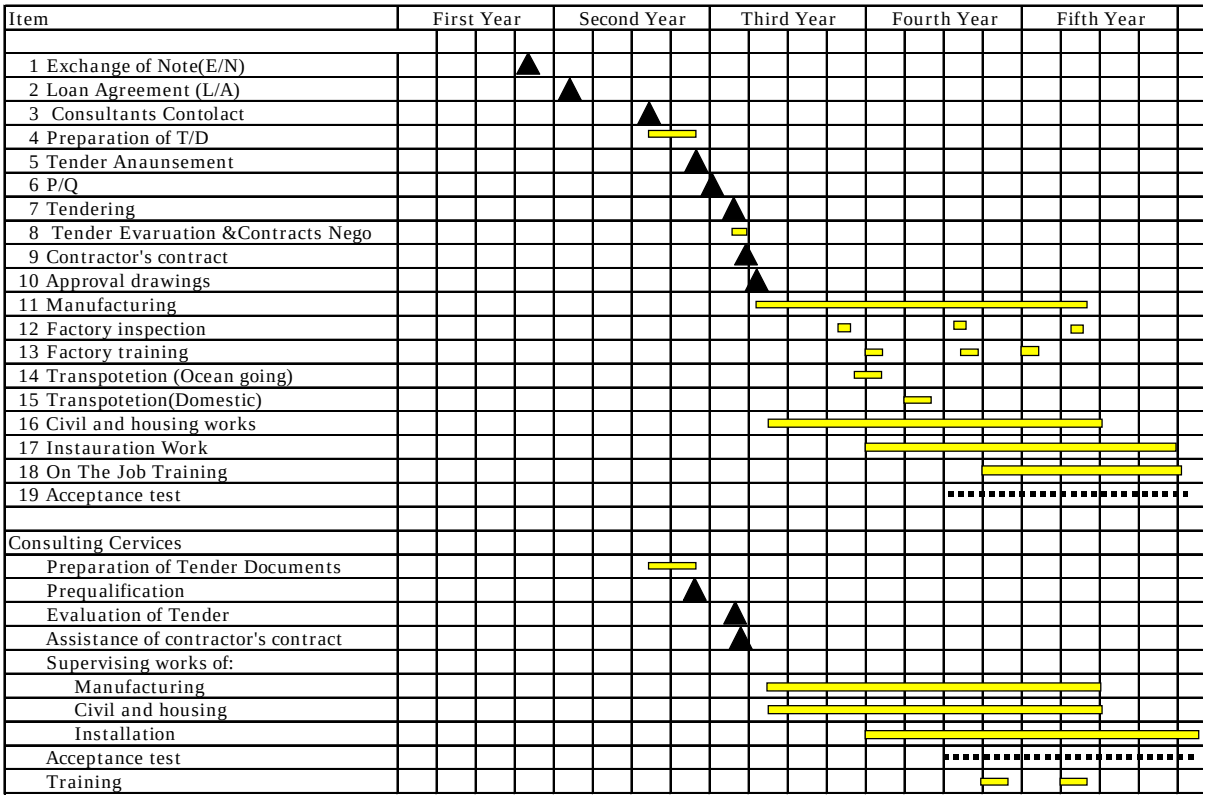
UKL and UPL Plans on the other planned 4 sites might be similar to the investigated 4 sites and then those plans shall be established based on the above

4 investigated site plans.

18.7. Implementation Schedule

The Implementation Schedule for proposed Priority Project is shown in **Table 18.6.**

Table 18.6. Implementation Schedule for Aids to Navigation including Supporting Facilities in proposed Priority Project



18.8. Project Cost Estimation

The project cost for the Project composes the following items:

(1) Procurement of Equipment
(2) Civil and Housing Works
(3) Installation Works
(4) Transportation
(5) Consulting Services
(6) Fiscal Contingencies

The project cost was estimated on the basis of the design concept. It is summarized as shown in **Table 18.7.**

Table 18.7. Summary of Estimated Project Cost

Unit: Thousand US$

Item	Foreign Currency	Local Currency	Amount
A. Procurement of Equipment	15,467	819	16,286
B. Civil & Housing Works	0	3,416	3,416
C. Installation Works	0	1,469	1,469
D. Transportation	309	212	521
E. Consulting Fee	1,398	592	1,990
F. Fiscal Contingency	859	325	1,184
Total	18,034	6,833	24,867

18.9. Operation and Maintenance Cost

Operation and maintenance cost was estimated on the basis of the followings:

(1) Personal expense for lighthouse keepers of eight (8) lighthouses to be developed shall be estimated.
(2) Operation and maintenance cost for equipment and system to be installed newly including rehabilitation and improvement as well as development shall be estimated.
(3) Lifetimes of major equipment shall be considered for cost estimation. Equipment with 10 years of lifetime shall be replaced two (2) times in 30 years after the establishment of a light.
(4) Cost estimation was made on the basis of tentative pattern of maintenance for visual aids to navigation and supporting facilities prepared prior to the estimation.

Result of cost estimation for operation and maintenance is shown in **Table 18.8.**

Table 18.8. Operation and Maintenance Cost for the proposed Priority Project

Unit: US$

Year	Lantern only	Steel Lattice Light Tower (Complete Set)	Alminum Light Tower (Complete Set)	Light Buoy	Workshop	Total
2008	4,252	4,594	371	0	20,366	29,582
2009	15,409	18,836	1,088	26,085	20,366	81,784
2010	4,252	16,879	371	0	20,366	41,867
2011	15,409	18,836	1,088	234,384	20,366	290,083
2012	140,485	910,783	8,954	0	20,366	1,080,588
2013	15,409	18,836	1,088	26,085	20,366	81,784
2014	4,252	43,790	826	0	20,366	69,234
2015	15,409	18,836	1,088	624,365	20,366	680,064
2016	4,252	16,879	371	0	20,366	41,867
2017	475,808	1,064,068	49,420	1,766,310	793,866	4,149,473
2018	4,252	16,879	371	0	20,366	41,867
2019	15,409	18,836	1,088	232,460	20,366	288,159
2020	4,252	16,879	371	0	20,366	41,867
2021	15,409	53,439	1,088	234,384	20,366	324,686
2022	140,485	910,783	25,216	0	20,366	1,096,849
2023	15,409	18,836	1,088	248,430	20,366	304,129
2024	4,252	16,879	371	0	20,366	41,867
2025	15,409	18,836	1,088	234,384	20,366	290,083
2026	4,252	16,879	371	0	20,366	41,867
2027	1,542,639	2,153,980	127,447	2,520,317	1,647,919	7,992,303
2028	4,252	0	743	0	20,366	25,360
2029	15,409	18,836	1,088	234,384	20,366	290,083
2030	4,252	16,879	371	0	20,366	41,867
2031	15,409	18,836	1,088	248,430	20,366	304,129
2032	140,485	910,783	25,216	0	20,366	1,096,849
2033	15,409	18,836	151	234,384	20,366	289,146
2034	4,252	16,879	371	0	20,366	41,867
2035	15,409	53,439	1,088	248,430	20,366	338,732
2036	4,252	16,879	371	0	20,366	41,867
Total	2,675,829	6,445,927	253,659	7,112,832	2,991,661	19,479,908

18.10. Economic Analysis

(1) Purpose

For the effective use of limited resource (human resources, commodities, currency), cost benefit analysis should be implemented quantitatively and qualitatively. The cost benefit analysis should be implemented quantitatively as far as possible from the viewpoint of effective utilization of resources. The items, which cannot be converted into currency, should be expressed by qualitatively.

(2) Specification of Project

① Rehabilitation and improvement of visual aids to navigation.

Rehabilitation and improvement of visual aids to navigation are as follows:

a. Light Houses	21 Locations
b. Light Beacons	131 Locations
c. Light Buoys	61 units selected by operation status

② Development of visual aids to navigation and supporting facilities

Development of Visual aids to navigation and supporting facilities are as follows:

a. Light Houses	8 Locations
b. Light Beacons	33 Locations
c. Light Buoys	34 units

(3) Evaluation Period of Projects

The evaluation periods of projects is 30 years,

(4) Result of Economic Analysis

Economic internal rate of return (EIRR) shows 12.00 %. In this case, EIRR is bigger than social discount rate; therefore this project has enough benefit. .

18.11. Financial Analysis

(1) Purpose

The projects under review have expected light dues. From the view point of GOI, feasibility of these projects shall be analyzed. Purpose of this Study is as follows;

① Profitability of this project

② By implementing this project, is a sound financing of GOI maintained?

③ To implement the project, suggest suitable measures from the financial angle.

(2) Consideration for Financial Internal Rate of Return (FIRR)

To examine the feasibility of the project, consideration for FIRR should be

implemented.

As a result of calculation, necessary light dues to achieve 1.8% of FIRR (GDP: Likeliest Case) are 6.41% of light dues.

If GOI want to implement projects with 1.8% of FIRR (GDP: Likeliest Case), 6.41% of light dues are needed and GOI have to prepare 3.730 million USD as a down payment.

(3) Sensitive Analysis

Sensitive analysis should be implemented among three GDP cases. To implement Aids to Navigation including Supporting Facilities, necessary light dues are 6.41% in likeliest case, 4.28% in optimistic case, 9.39% in pessimistic case.

CHAPTER 19.
DIFFERENTIAL GLOBAL POSITIONING SYSTEM (DGPS)

19.1. Introduction

The study is made to clarify feasibility of establishment for DGPS system at Jakarta, Benoa and Makassar.

19.2. Objective of the Project

The proposed Priority Project on Rehabilitation for MFB stations in Indonesia (hereinafter referred to "the Project") has the objective to improve the functionality of the existing MFB stations installed under the Japanese Yen Loan project by providing those stations with DGPS for navigation purpose that is capable of providing highly accurate ATN services, in order that Indonesia may be able to fulfill its international responsibility as one of the signatories of SOLAS Convention in keeping improved safety of navigation and promoting efficient maritime traffic activities.

19.3. Effectiveness of DGPS

It is expected that the introduction of DGPS system will make effectiveness as follows:

(1) Improvement of vessel traffic safety

Twenty-two (22) % of marine casualties occurred around Indonesian waters are collision and stranding. Major causes of them are:

- Mistake of positioning of vessel, and
- Unfamiliarity with the waters.

It is expected that the improvement of positioning accuracy by DGPS will greatly decrease those marine causalities caused by a mistake and unfamiliarity.

(2) Improvement of efficiency of vessel operation (decrease of navigation cost)

With the improvement of positioning accuracy, the positioning of vessels can be secured and efficiency of vessel operation will be improved and navigation cost will be decreased.

(3) Meeting international standards as a maritime country (For Authorities)

In the Resolution A.815 (19) of IMO, it is recommended that a radio navigation system used to assist the navigation of ships in those harbor entrances and approaches and other waters where freedom to maneuver is limited shall provide positional information with an error not greater than ten (10) m with a probability of ninety-five (95)%.

(4) Meeting new international standards and development of infrastructure

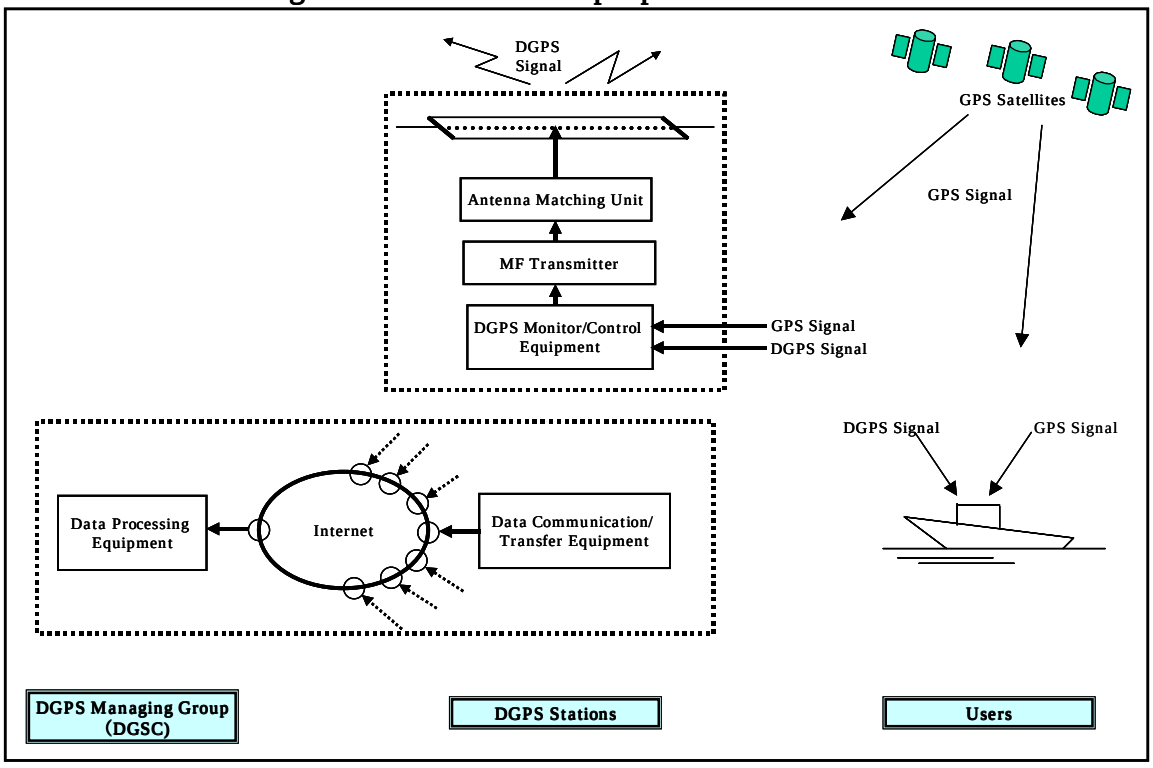
DGPS will become an infrastructure of AIS with factor of "Position", "Course" and "Speed".

19.4. Outline of DGPS

The DGPS system is composed mainly of "DGPS transmitting system" and "DGPS monitoring system" as shown in **Figure 19.1.** The DGPS transmitting system is composed of a transmitting antenna, antenna-matching unit, MF Transmitter and DGPS monitor/control equipment. The DGPS monitoring system is composed of Data communication/transfer equipment and Data processing Equipment that are able to communicate each other by INTERNET. The DGPS Managing Group will be finally able to have the DGPS monitoring data of DGPS stations.

The navigating vessels within the service coverage of DGPS stations are not only able to use DGPS signal for correction of vessel position, but also confirm the integrity of system that guarantees positioning accuracy.

Figure 19.1. Outline of proposed DGPS stations



19.5. Operation and Maintenance, and Management System Plan

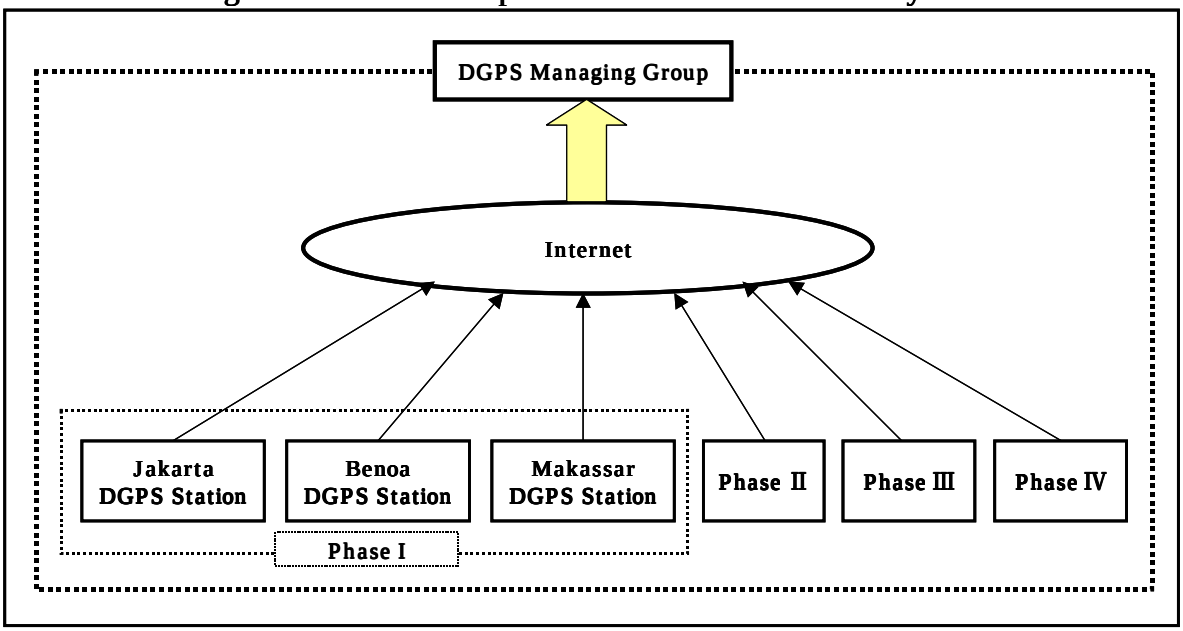
Most of the existing MFB stations constructed under the Japanese Yen Loan had been suspended their operation several years after their starts because of lack of operation and maintenance costs and weakness of operation and maintenance management system.

It is expected that the supplementary budget from light dues can be utilized for the operation, maintenance and management of DGPS system.

For the operation and maintenance system, DGPS Operation and Maintenance System was planned as shown in **Figure 19.2.**

In this plan, the DGPS Managing Group having overall responsibility for the operation and maintenance of the system will be established in the Directorate General of Sea Communication (DGSC), Ministry of Communications (MOC) and at least two dedicated maintenance technicians should be assigned to each DGPS station. Therefore, it is deemed that continuous and stable operation and maintenance of the system will be secured.

Figure 19.2. DGPS Operation and Maintenance System Plan



19.6. Project Locations and Coverage Area of DGPS Stations

Project locations selected for the proposed priority project are Jakarta, Benoa and Makassar. DGPS Managing Group is established at DGSC, Jakarta.

The basic concept of this plan is that three (3) DGPS stations are established at existing coastal radio stations where commercial power source is available. The DGPS technique is applied to the DGPS stations to serve a stable and high accuracy positioning information with Integrity of the system to vessel that can navigate with more safety and have high efficiency.

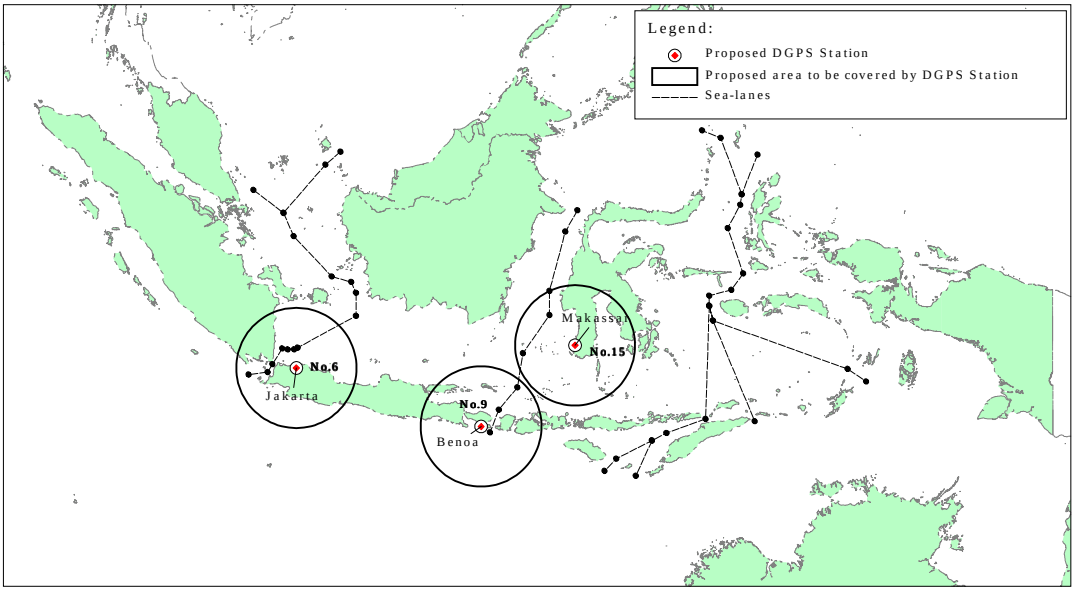
These DGPS stations cover the following waters:

① Waters in and around ports and harbors, where entry and departure of ships are difficult

② Narrow channels, and the waters where there are dangerous reefs or a group of islands

Coverage area of three (3) DGPS stations are shown in **Figure 19.3.**

Figure 19.3. Service Coverage of DGPS Stations proposed in Priority Project



19.7. Allocation Plan of Main Equipment

The main equipment to be supplied for the proposed priority project is as follows:

(1) GPS Transmitting system for three (3) DGPS stations

(2) DGPS Monitoring system for three (3) DGPS stations and DGPS Managing.

(3) Power supply system for three (3) DGPS stations

(4) Spares stored at three (3) DGPS stations and DGPS Managing Group for operation and maintenance.

The proposed DGPS system above is planned on the basis of the following basic concepts:

① Compliance with international standards and Indonesian Law,

② Establishment of long-term operation,

③ Securing stable operation of system and easy maintenance,

④ Minimization of maintenance cost,

⑤ Consideration of environmental condition,

⑥ Rehabilitation of the existing equipment on the DGPS system,

⑦ Maximal utilization of existing equipment and facilities, and

⑧ Securing the stable operation and maintenance system.

⑨ Providing sufficient spare parts

⑩ Proposed equipment for DGPS stations and associated facilities and goods basically follows equipment plan specified in “Basic Design Study Report on the Project for Rehabilitation for Medium Wave Radio Beacon Stations in the

Republic of Indonesia" in November 2000.

19.8. Implementation Schedule

It is desirable that DGPS Stations are established by the fund of DGSC.

However, in case that DGSC has insufficient fund, Loan may be considered for earlier establishment of DGPS stations to contribute to safe navigation in the waters in and around ports and harbors, where entry and departure of ships are difficult, and narrow channels, and the waters where there are dangerous reefs or a group of islands.

19.9. Project Cost Estimate

The total investment cost of proposed priority project of DGPS is shown in **Table 19.1.**

Table 19.1. Estimated Total Investment Cost

Unit: Thousand US$

Item		Foreign Currency	Local Currency	Amount
A	Procurement of Equipment	3,670	209	3,879
B	Installation Work	374	30	404
C	Spares	447	18	465
D	Civil and housing works	0	59	59
E	Training	92	0	92
F	Ocean Transportation	74	4	78
G	Consulting Fee	326	76	402
H	Contingency	249	20	269
Total		5,232	416	5,648

19.10. Operation and Maintenance Cost

The operation and maintenance cost for three (3) DGPS stations and DGPS Managing Group is estimated on the basis of the following:

(1) 5 persons of DGPS Managing Group at DGSC consist of head and 4 staff.

(2) 2 technician of Each DGPS stations have a responsibility for maintenance, system is operated automatically.

Total operation and maintenance cost per year is US$26,606.

19.11. Economic Analysis

The approach and methodology of the economic analysis should be implemented quantitatively as far as possible, however, the items, which cannot be converted into currency, should be expressed by qualitatively.

With case means the estimate of decrease effects of vessel's collisions by the projects, without case means zero effects without the projects.

The benefits of DGPS are the decrease of Vessel's collisions and that of running

aground. They are depending on the accuracy of vessel's position. Generally they say the accuracy of DGPS is 1 meter and that of GPS is 10meters. According to the measurement of GPS by the study team, the accuracy of GPS was 10.5 meters with 95% probability. However, in the range of normal navigation, it is very difficult to evaluate the difference of the accuracy, which has a range between 1meter and 10.5 meters in normal navigation. Because even if small vessels, master of the vessel expect the error of ships position more than 10 meters. Therefore estimate of quantitative benefits for GPS is almost impossible in the range of this study.

19.12. Financial Analysis

Necessary light dues to achieve 1.8% of FIRR (GDP: Likeliest Case) are 1.64 % of light dues.

Sensitive analysis should be implemented among three GDP cases. To implement DGPS, necessary light dues are 1.64% in likeliest case, 1.10% in optimistic case, and 2.41% in pessimistic case.

CHAPTER 20.
VESSEL TRAFFIC SERVICE (VTS)

20.1. Introduction

The objectives of this study are to clarify feasibility of establishment for VTS System at Sunda and Lombok Strait area.

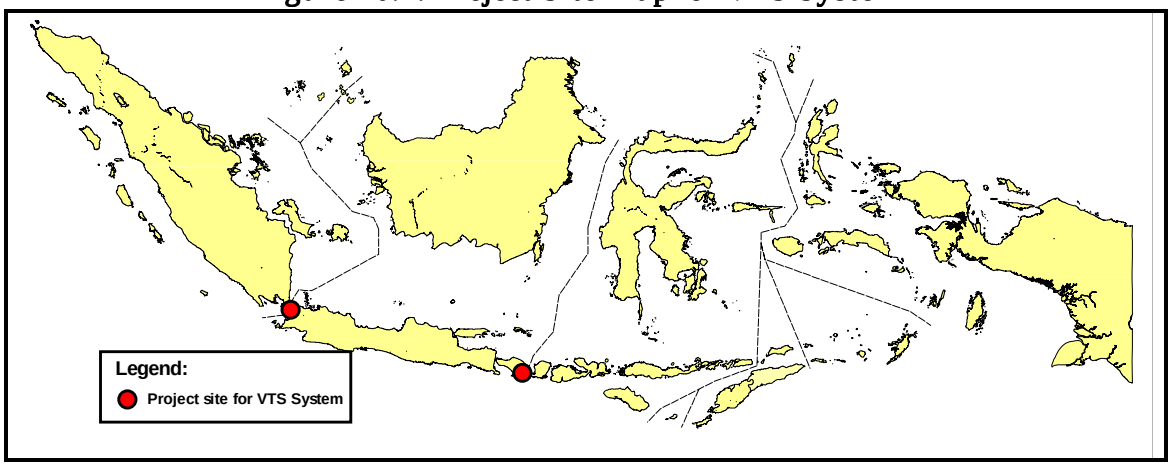
20.2. Necessity of VTS System

20.2.1. Background

In 1994, the United Nation Convention of the Law of the Sea (UNCLOS) recognized Indonesia as an archipelagic state. This means that Indonesia has given the nation right and responsibility to monitor marine traffics in its territorial waters. Most of vessels navigating from Indian Sea to Pacific Ocean is passing the Malacca and Singapore Straits. Those vessels are monitored and managed by VTMS that has been established upon agreement among Indonesia, Malaysia and Singapore. Other vessels are passing three (3) sea route as shown in **Figure 20.1** such as Sunda Strait – Kalimata Strait route heading South China Sea, Lombok Strait – Makassar Strait route heading Pacific Ocean and Banda Sea – Maluku Sea route. Indonesia planed to organize vessels navigating the foresaid routes by formulation of three (3) sea lanes and proposed this plan to IMO in 1997. IMO approved this proposal in 1998.

In this connection, DGSC has decided to develop safety measures such as Lighthouse, Light beacon and Buoy that are constructed along the three (3) sea lanes to enhance safety measures by German Project. On the other hand, DGSC decided to develop VTS that monitors and manages vessels navigating in the sea. Project site of Priority Project is shown in **Figure 20.1.**

Figure 20.1. Project Site Map for VTS System



20.2.2. Formation of VTS System

An announcement was given in "the Jakarta Post" by Minister of Foreign Affair to establish monitoring system for sea lane, but, as of December 2001, monitoring system for vessels was not yet established. On the other hand, DGSC has plan to establish the complete VTS System that covers whole sea lanes, but it has some problem such as technical, financial ones and capability of human resource.

Then, we, Study Team, concluded that Sunda strait and Lombok Strait area should be the first areas to establish VTS System because of the following reasons:

(1) Sunda and Lombok Straits are the most suitable areas to grasp status of navigating vessels in Sea Lane Ⅰ & Ⅱ.
Ferryies are operating most frequently in Sunda Strait and it is main transportation route between Sumatra and Java.

(2) Chemical industries, Oil finery/terminal and Electric power plant are located at the sea shore of Sunda Strait where vessels carrying dangerous cargo are navigating.

(3) Oil terminal is located at east sea shore of Bali Island, so that vessels carrying dangerous cargo are navigating in Lombok Strait.

(4) Sea recreation area is located at periphery of West-south side of Sunda Strait and at North-east side of Lombok and East side of Bali Island where should be protected from the pollution caused by casualty of vessel because many tourist will visit for enjoying sea leisure. In case a marine accident is occurred, economic loss may be serious.

(5) Marine casualties related with sea lane are observed at Sunda and Lombok Strait

As our conclusion, we decided that Sunda and Lombok Strait is the most suitable area to be established the first VTS System in Indonesia. At the same time, establishment of those VTS in Strait areas is useful to assist solution of DGSC ‘s problem such as technical one and problem of human resource and formulation of regulation in nation wide. DGSC will have enough knowledge to improve VTS System to nation wide and to create regulations and standards for organizing vessels navigating in sea lanes.

20.3. Proposed Radar and AIS Sites

Four (4) proposed sites were assigned as Radar and AIS site in Sunda and Lombok Straits areas respectively. Site surveys were carried out for those proposed sites to grasp present status.

Detailed data for Sunda sites are shown in **Table 20.1** and detailed data for Lombok sites are shown in **Table 20.2**

Table 20.1. Proposed Sites for Radar and AIS Sites of Sunda Strait

Site No.	Name (Island)	Position		Altitude	Cover Angle (°) North = 0°	Access	Feature	
		Latitude	Longitude				Advantage	Disadvantage
1.	Merak (Java)	S05° 54' 35"	E106° 00'00"	134m	210°～45°	375m	Ferry-route for Merak-Bakahuni is well covered.	Shadow of Pulau Sangian.
2.	Pasir Maremang (Java)	S06° 02' 20"	E105° 57'10"	218m	210°～21°	200m	South entrance of the Strait is well covered	Shadow of the Sangian on the Ferry Route
3.	Kadudago Hilir (Java)	S06° 06' 10"	E105° 55'07"	225m	222°～22°	Mosque on the top the mountain.	Easy to access	Ditto
4.	Pulau Rimaubalak (Sumatra)	S05° 51' 33"	E105° 46'41"	220m	16°～232°	Submarine power Cable: 2km is necessary	Well covered sea lane area	Maintenance on the island. Shadow of Pulau Panjurit is small

Table 20.2. Proposed Sites for Radar and AIS Sites of Lombok Strait

Site No.	Name (Island)	Position		Altitude	Cover Angle (°) North = 0°	Access	Feature	
		Latitude	Longitude				Advantage	Disadvantage
1.	Selang, West-ward of the light house Gili Selang (Bali)	S08° 23' 40"	E115° 41'40"	508m	0°～219°	300m	Sea lane and Ferry route are well covered	South part of Lombok Strait is too far
2.	Tanglad (Nusa Penida)	S08° 46' 29"	E115° 35'	420m	0°～210°	Village top. Road and Power line is available	Near to Ferry Route and the Strait	Maintenance on the island.
3.	Bt. Bangkobangko (Lombok)	S08° 43' 59"	E115° 50'52"	141m	225°～ 73°	Far from the Village	Near to Ferry Route and the Strait.	Difficult to approach.
4.	Bt. Mangsit (Lombok)	S08° 28' 03"	E116° 03'28"	505m	320°～ 15°	No road 3000m	High altitude.	Far from the strait and ferry route.

20.4. Selection of Site for Radar and AIS Sites

Four (4) proposed sites survey were carried out at Sunda Strait area and Lombok Strait area. The result of Survey was evaluated, and project site and system configuration for Priority Project were decided.

20.4.1. Sunda Strait Area

In Sunda Strait Area Site-No.1, Merak Hill-top is the best location and Co-ordinate of proposed site is S005 ° 55' 35" E105 ° 59' 58".

20.4.2. Lombok Strait Area

In Lombok Strait Area Site-No.2, (Bukit Tunjukpusuh in Tanglad) is the best location and Co-ordinate of proposed site is S008 ° 46' 57" E115 ° 35' 40".

20.5. Selection of Site for Sub Center

Sub Center has functions to monitor, manage and advice vessels navigating in strait and related area. It is a sub system of VTS System. Sub Center should be located at a convenient position to attain the foresaid role. On the other hand, Sub Center has to receive information from radar and/or AIS, so that Sub Center should be located at convenient point in aspect of communication.

20.5.1. Sunda Strait Area

Two sites are proposed as potential site; one is SROP (Coastal Radio Station in Merak); the other is Office of ADPEL (Administrator of Port).

Feature of these 2 sites are compared and finally the Office of ADPEL is selected, because this office is easier to link with radar station.

20.5.2. Lombok Strait Area

Two sites are proposed as potential site; one is Office of Port Officer in Padangbai and the other is Coastal Radio Station in Benoa.

Features of these 2 sites are compared and finally the Coastal Radio Station in Benoa is selected, because this station is easier to link with remote station by microwave.

20.6. System Design

20.6.1. System Configuration

The VTS System is composed of Remote station, Sub Center and related sub-system.

20.6.2. Equipment Specification

Specification of equipment is summarized as follows:

(1) Radar System

X-Band Radar with large size antenna is fitted for Long Range Radar and is composed of the following sub-system.

① Radar Antenna

② Radar Transmitter- Receiver

To protect the other radar against interference and 2nd time around echoes, pulse repetition agility is provided.

③ PPI Monitor

The PPI monitor is provided for maintenance of radar system at radar site.

④ Radar Signal Preprocessor

⑤ Radar Terminal Controller

(2) VHF Radio system

The VHF radio transceiver is installed and used to communicate with vessels.

(3) AIS (Automatic Identification System)

The AIS is used to receive vessel position data including other relative navigation information by automatic operation. The received information is sent automatically to sub center and main center.

(4) Sub Center System

Sub Center is composed of equipment as follows:

① Operator Console

② Terminal Controller

③ Radar data Processor: Refresh cycle time 10sec

④ AIS data terminal

⑤ Satellite modem for Center

⑥ VHF Controller

⑦ Power supply:

(5) Software

- OS of UNIX or WINDOWS (WINDOWS-NT4.0 or higher) is adopted as operating system.

- C-language is adopted as application source language.

(6) Micro radio link

The Micro radio link is used for communication between Tanglad radar/AIS site and Benoa Sub Center. AIS sites and Sub Center are connected by Micro Radio Link to transfer information.

(7) Optical Fiber cable link

Optical Fiber link is adopted to communicate Merak radar/AIS project site with Merak ADPEL Sub Center.

20.6.3. Civil Work

To establish the radar/AIS as sensor of VTS system, civil work is required. Necessary civil works are summarized in the following **Table 20.3.**

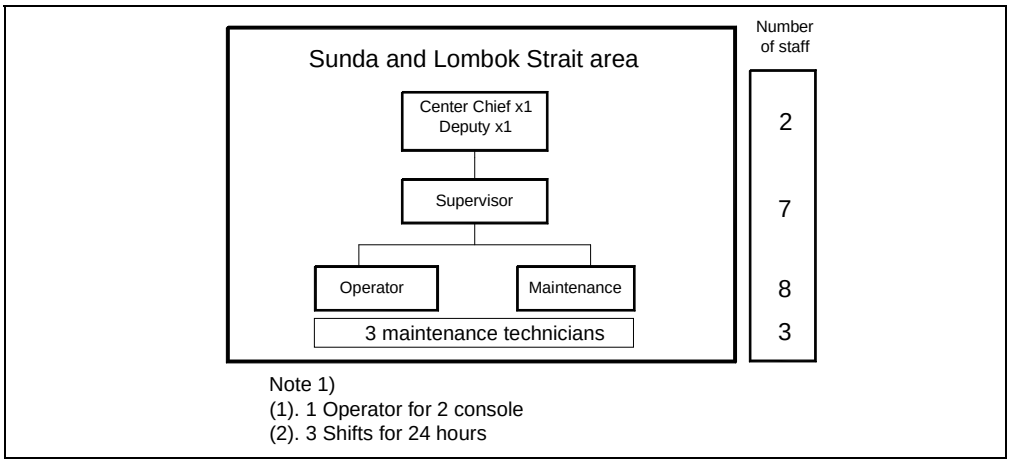
Table 20.3. Summarized Work Items for Civil Works

No.	Work items	Specification and quantity	
		Merak project site	Tanglad project site
1,	Cleaning and leveling including excavation	Cleaning and leveling ($1300m^2$), 1 lot Excavation (Soft rock, $13m^3$), 1 lot	Cleaning and leveling ($1300m^2$), 1 lot Excavation (Soft rock, $13m^3$), 1 lot
2.	Equipment house and guard house	13 x8.0 m, 1 set 8.5 x 9.5m, 1set	13 x8.0 m, 1 set 8.5 x 9.5m, 1set
3.	Erection antenna tower including materials and foundation (Earth resistance, less than 10ohm).	20m High square tower with foundation, 1 set	20m High square tower with foundation, 1 set
4.	Access road	1500m x 2.5m with paved by asphalt., 1 lot	Not applied.
5.	Construction of feeding line for commercial power line (20kV, 3).	500m with materials (Pole, insulator, wire, foundation and others)	1700m with materials (Pole, insulator, wire, foundation and others)
6.	Feeding of Optical fiber cable.	500m with materials (Pole, foundation and others)	Not applied.
7.	Power receiving facilities including Engine generator	7.5kVA E/G including foundation and fuel tank,. 1set	5kVA E/G with foundation, 1 set
8.	Fencing and pavement.	Fence: 133m, 1 lot Pavement: $155m^2$, 1 lot	Fence: 133m, 1 lot Pavement: $155m^2$, 1 lot
9	Earth grounding work (Earth resistance, less than 10ohm)	1 lot	1 lot
10.	Ancillary work	1 lot	1 lot

20.7. Operation and Maintenance

Operation group is provided to operate and maintain VTS System for 24-hour bases in Sub Center. Operation group composes of Deputy manager, Supervisor, Operator and Maintenance technician. Detailed Organization is shown in **Figure 20.2.**

Figure 20.2. Organization of Operation and Maintenance for VTS System



20.8. Environmental Assessment

Investigation of Environmental Management Effort (UKL) and Environmental Monitoring Effort (UPL) were carried out and this investigation was re-entrusted to local consultant.

20.8.1. Outline of Investigation

(1) Basic concept

The investigation was conducted based on the concept provided in the Decree of the Minister of Communication No.KM4 and KM5 Year 1996.

(2) Survey of present environmental conditions

Data collection, field survey, hearing to community residents and concerned people, laboratory testing and analysis of present environmental conditions were conducted

(3) Study on impacts arising from planned project

Based on the results of above survey on the present environmental conditions at each site, impacts arising from the planned project were studied.

(4) Establishment of UKL and UPL plans

Based on the results of the above study on environmental impacts arising from the planned project, UKL Plans and UPL Plans were established.

20.8.2. Results of the Investigation

Based on the results of the investigation, it is concluded as follows;

(1) Environmental impacts arising from planned VTS system projects at 2 sites on the above mentioned environmental components are classified as not significant.

(2) However, UKL and UPL on the "Land release compensation" and "Employment opportunity for local people " for 2 sites should be conducted.

20.9. Implementation Time Schedule

Implementation duration of priority project is estimated such as 48 months for assignment of consultant, detailed design, tendering and contract and other work items. Latest 12 months before service-in is proposed for Test operation and OJT to familiarize the VTS System. Operation procedure for VTS System such as receiving information from shipper and dissemination of information should be established during implementation phase. Proposed implementation time schedule is shown in **Table 20.4..** as follows:

Table 20.4. Implementation Time Schedule

No.	Description	Year																	
		1st Year			2nd Year			3rd Year			4th Year			5th Year			6th Year		
1.	Exchange of Note (E/L)																		
2.	Loan Agreement (L/A)																		
3.	Asignment of Cosultant																		
4.	Detailed Design																		
5.	Preparation of Tender document																		
6.	Prequalification (P/Q)																		
7.	Tendering and Contract																		
8.	Approval of Drawings																		
9.	Securement of premise																		
10.	Civil construction																		
11.	Manufacturing of Equipment																		
12.	Inland Transportation																		
13.	Ocean Transportation																		
14.	Installation of equipment																		
15.	Inspection																		
16.	Taining																		
17.	Test operation and OJT																		
18.	Service-in																		

20.10. Project Cost Estimate

JICA Study Team completed site survey for four (4) proposed sites at Sunda and Lombok Strait area and system design was finalized. Cost estimation was carried out based on survey result for equipment and civil works.

Total investment cost of Priority project is comprised of Procurement of equipment, Equipment setup included installation cost, Civil work, training and engineering cost and is shown in **Table 20.5.**

Table 20.5. Estimated Total Investment Cost

Unit: Thousand US$

No. Items	Sunda Strait		Lombok Strait	
	Foreign	Local	Foreign	Local
Grand total	4,167	222	1,452	215

20.11. Operation and Maintenance Cost

20.11.1. Operation Cost

Operation cost is estimated. Operation cost is composed of Personnel charge, Electricity charge and Consumable parts cost. Each cost is estimated as shown in **Table 20.6.**

Table 20.6. Estimation of Operation Cost per Year

Unit : Thousand Rupiah

	Sunda Strait area	Lombok Strait area
Total cost per year	417,507.-	316,651.-

20.11.2. Maintenance Cost

Daily maintenance is carried out by technical staff of Coastal Radio Station of Merak and Padangbai. Staff of Tg. Priok and Benoa Costal Radio Station support staff of Merak and Padangbai staff if support is required.

In case heavy failure is occurred, technician of supplier is dispatched to carry out repair work from Jakarta. Spare parts supplied by original contract are utilized as parts for repair. Maintenance cost is estimated as shown in **Table 20.7.**

Table 20.7. Maintenance Cost per Year

Unit: Rupiah

	Sunda Strait area	Lombok Strait area
Total charge per year	3,520,000.-	8,660,000.-

20.12. Economic Analysis

Economic Analysis was carried out to calculate FIRR that is 17.3% in likeliest.

Economic Analysis is shown in **Table 20.8.**

Table 20.8. Economic Analysis for VTS System

Year		Social Discount Rate	Benefit		Remaining Price	Present Value	Civil		Operating & Maintenance Cost		Present Value of Costs
			Benefit	Present Value			Cost	Present Value	Coat	Present Value	
		10%									
2003	1	1									
2004	2	0.900					1.214	1.093			1.093
2005	3	0.810					1.817	1.472			1.472
2006	4	0.729					2.420	1.764			1.764
2007	5	0.656	1.207	0.792		0.792	0.605	0.397			0.397
2008	6	0.590	3.323	1.962		1.962			0.075	0.044	0.044
2009	7	0.531	3.810	2.025		2.025			0.075	0.040	0.040
2010	8	0.478	4.370	2.090		2.090			0.075	0.036	0.036
2011	9	0.430	5.011	2.157		2.157			0.075	0.032	0.032
2012	10	0.387	5.746	2.226		2.226			0.075	0.029	0.029
2013	11	0.349	6.589	2.297		2.297			0.075	0.026	0.026
2014	12	0.314	7.555	2.371		2.371			0.075	0.023	0.023
2015	13	0.282	8.664	2.447		2.447			0.075	0.021	0.021
2016	14	0.254	9.935	2.525		2.525			0.075	0.019	0.019
2017	15	0.229	11.392	2.606		2.606			0.075	0.017	0.017
2018	16	0.206	13.064	2.690		2.690			0.075	0.015	0.015
2019	17	0.185	14.980	2.776		2.776			0.075	0.014	0.014
2020	18	0.167	17.178	2.865		2.865			0.075	0.012	0.012
2021	19	0.150	19.699	2.957		2.957			0.075	0.011	0.011
2022	20	0.135	22.589	3.051	0.606	3.657			0.075	0.010	0.010
TTL		8.884	155.112	37.837	0.606	38.443	6.056	4.725	1.120	0.350	5.076
										EIRR	**17.3%**

20.13. Financial Analysis

To implement the project for VTS system, necessary light dues are 2.03% in likeliest, 1.36% in optimistic case and 2.98% in pessimistic case. It is summarized in **Table 20.9.**

Table 20.9. Sensitive Analysis

Necessary Light Dues		
Case	Percentage	Remarks
Likeliest	2.03%	
Optimistic	1.36 %	
Pessimistic	2.98%	

CHAPTER 21.
GLOBAL MARITIME DISTRESS AND SAFETY SYSTEM (GMDSS)

21.1. Introduction

In accordance with the requirements of SOLAS Convention, DGSC is promoting to provide the required coast stations with GMDSS equipment such as DSC, NBDP and NAVTEX equipment.

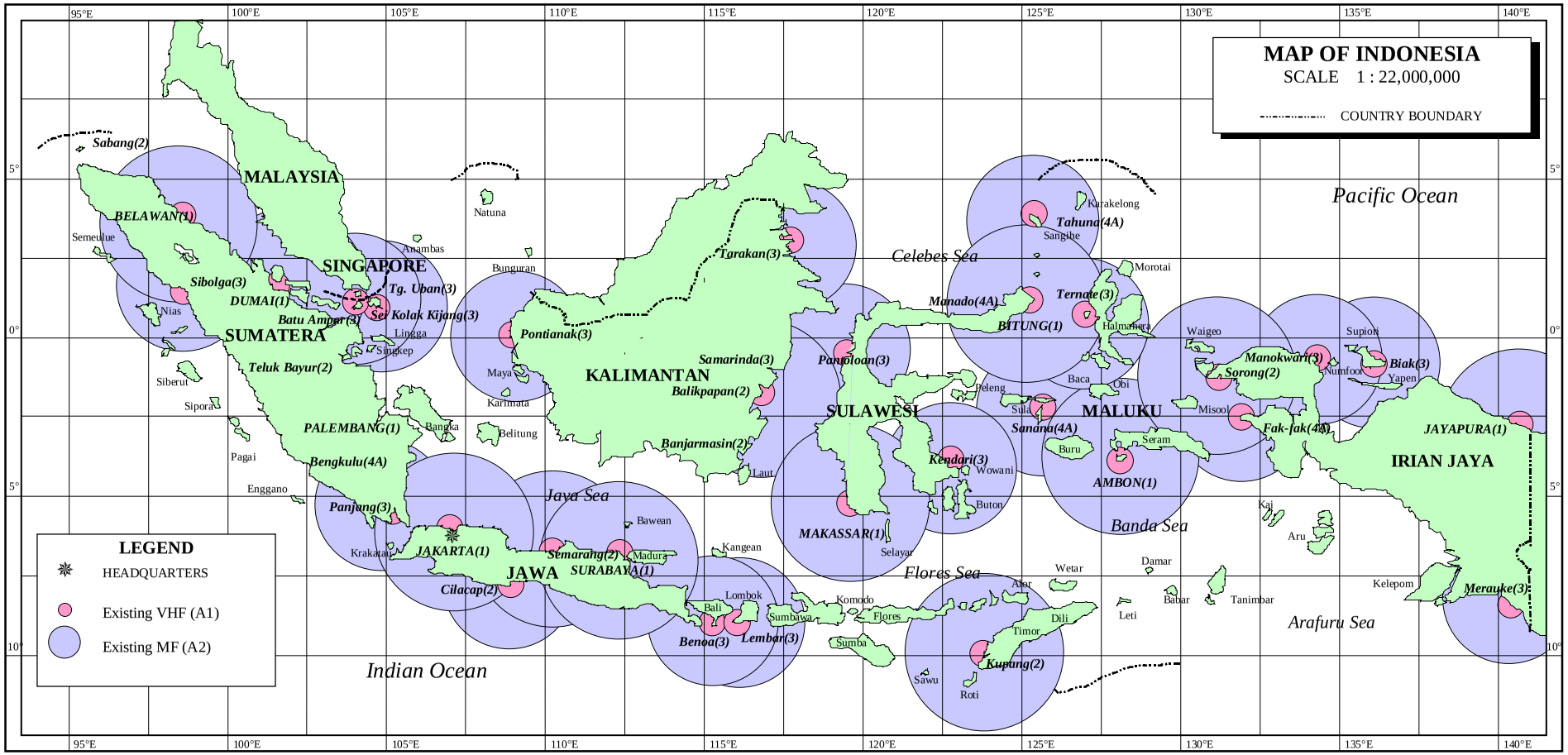
So far, DGSC installed HF DSC at 12 stations, MF and VHF DSC at 30 stations and NAVTEX transmitters at 4 stations under the Maritime Telecommunication System Project Phase Ⅲ and other projects.

Table 21.1. shows the list of GMDSS coast stations at present and **Figure 21.1.** shows the locations of those stations.

Table 21.1. GMDSS Coast Stations at Present

Class			A3 HF DSC	A2 MF DSC	A1 VHF DSC	NAVTEX	Remarks
I	1	Belawan	○	○	○		
	2	Dumai	○	○	○		
	3	Jakarta	○	○	○	○	
	4	Surabaya	○	○	○		
	5	Makassar	○	○	○	○	
	6	Bitung	○	○	○		
	7	Ambon	○	○	○	○	
	8	Jayapura	○	○	○	○	
II	1	Semarang	○	○	○		
	2	Cilacap		○	○		
	3	Kupang	○	○	○		
	4	Balikpapan	○	○	○		
	5	Sorong	○	○	○		
III	1	Sibolga		○	○		
	2	Batu Ampar		○	○		
	3	Sei Kolak Kijang		○	○		Eq'pt from Tg.Pinang
	4	Panjang		○	○		
	5	Benoa		○	○		
	6	Lembar		○	○		
	7	Pontianak		○	○		
	8	Tarakan		○	○		
	9	Kendari		○	○		
	10	Pantoloan		○	○		
	11	Ternate		○	○		
	12	Manokwari		○	○		
	13	Biak		○	○		
	14	Merauke		○	○		
IV	1	Tahuna		○	○		
	2	Sanana		○	○		
	3	Fak-fak		○	○		
Total No. of Station			12	30	30	4	

Figure 21.1. GMDSS Coverage Area (at Present)



Remarks: A3 area is covered by Belawan, Dumai, Jakarta, Surabaya, Makassar, Bitung, Ambon, Jayapura, Semarang, Kupang, Balikpapan and Sorong.

(1) HF DSC for Sea Area A3

Twelve (12) coast stations are installed with HF DSC equipment and are keeping watch for whole Sea Area A3.

There are no more needs to deploy HF DSC stations for Sea Area A3.

(2) MF DSC for Sea Area A2

Thirty (30) coast stations are installed with MF DSC equipment and are keeping watch for Sea Area A2.

There still remain blind zones in Sumatra, Kalimantan, Sulawesi and Irianjaya which need to be covered by MF DSC.

(3) VHF DSC for Sea Area A1

Thirty (30) coast stations are installed with VHF DSC equipment and are keeping watch for Sea Area A1.

There still remain a number of coast stations for main ports, major feeder ports and important navigation waters which need provision of VHF DSC equipment.

(4) NAVTEX

International NAVTEX using English are being serviced from Jakarta, Makassar, Ambon and Jayapura coast stations, and their coverage areas are shown in **Figure 21.2.**

However, National NAVTEX which are being serviced in many non-English countries in order to secure the safety of navigation for coastal and inter-islands shipping, has not been established yet in Indonesia.

21.2. Necessity of GMDSS Expansion

(1) GMDSS was developed by IMO, and put into service in February 1992 and fully implemented in February 1999. As for the shore-based facilities, Amendments to the 1974 SOLAS Convention, Chapter Ⅳ (Radio communications), Part B (Undertaking by Contracting Governments), Regulation 5 (Provision of radio Communication service) requires Contracting Governments to undertake to make appropriate shore-based facilities for GMDSS.

(2) Accordingly, so far DGSC installed HF DSC for Sea Area A3 at 12 coast stations and MF DSC for Sea Area A2 / VHF DSC for Sea Area A1 at 30 coast stations, and International NAVTEX transmitters at 4 stations.

However, there still remain many blind waters for Sea Area A2 and Sea Area A1, and National NAVTEX service has not been established yet in Indonesia.

(3) A lot of human lives have been lost every year in Indonesian waters by serious

marine accidents.

In many accidents cases, the lack of maritime telecommunication system is pointed out. Therefore, the probability of lives to be rescued will be much higher after the completion of GMDSS.

(4) Today, the countermeasures against piracy and armed robbery are the urgent issue for the coastal waters of Indonesia.

IMO recommends all ship masters that if they are or may be subject to piracy and armed robbery, they should quickly report the fact to the nearest Rescue Coordination Center (RCC) or coast station.

GMDSS is an effective means for piracy report from ship's master to nearby RCC or coast station.

(5) A lot of domestic and international vessels are engaging in transportations and fishing activities in Indonesian waters.

GMDSS provides many favorable effects and impacts on Indonesian social and economic activities by securing maritime safety and preventing marine environment.

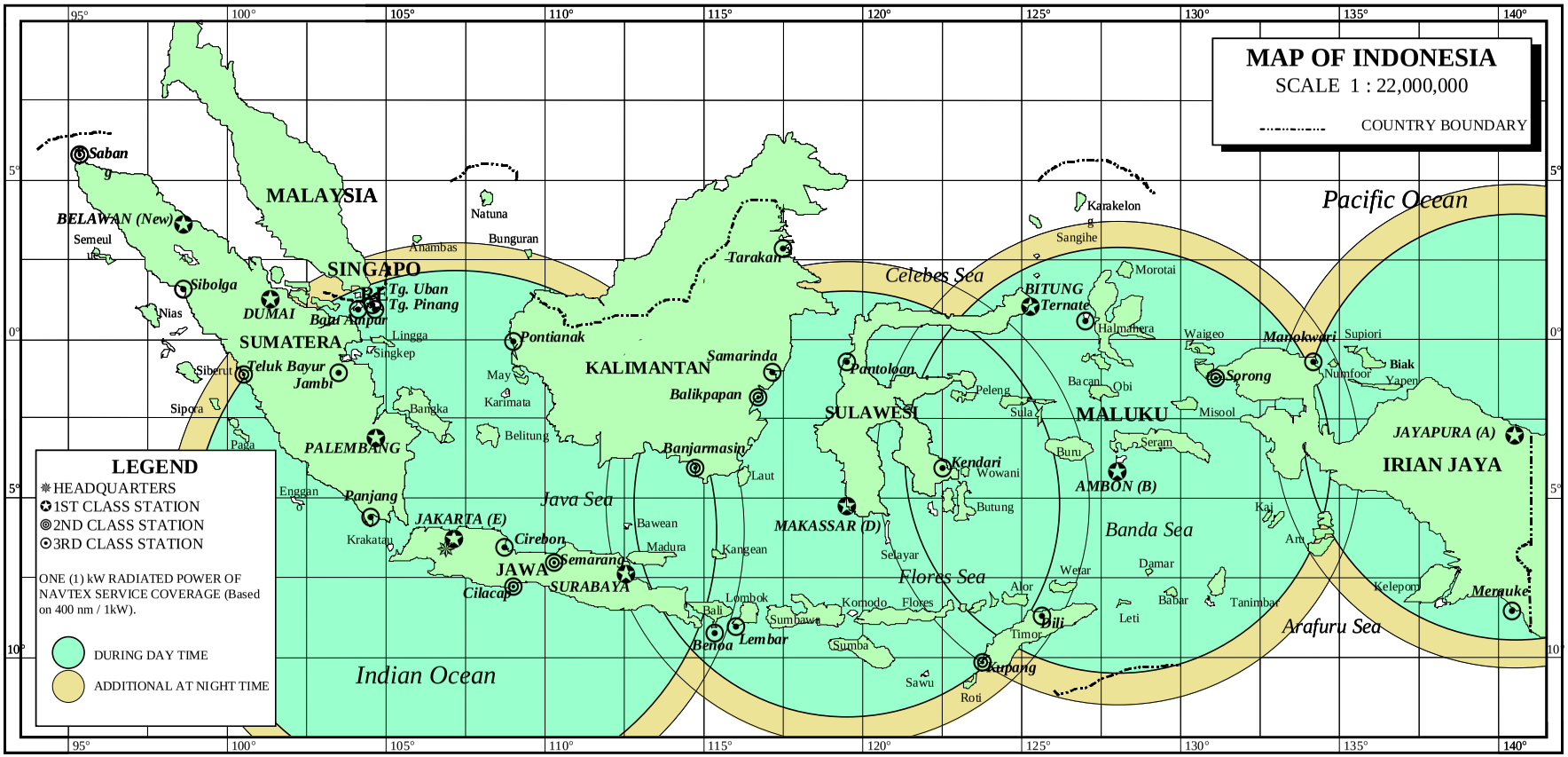
(6) GMDSS was developed with the aim that a distress vessel in any sea area can make a quick and secure request for rescue to maritime SAR authorities. Therefore in principle, the whole Indonesian waters should be covered by GMDSS.

However, as Indonesia shall hasten to establish GMDSS shore-based facilities and notify the coast stations list of GMDSS to IMO, the following GMDSS expansion and improvement should be implemented as an urgent project;

a. To cover major blind waters by MF DSC for Sea Are A2,
b. To cover waters in and around main ports and important navigation waters by VHF DSC for Sea Area A1,
c. To commence National NAVTEX service using a frequency and transmitters for International NAVTEX.
d. To improve coast stations having problems for enabling them to cover GMDSS

(7) Budget from Light Dues has been allotted to DGSC from 2001, thereby the maintenance and training fee for the maritime telecommunication system have been substantially increased and the maintenance conditions will be greatly improved hereafter.

Figure 21.2. NAVTEX Coverage Area (at Present)



21.3. Concept of GMDSS Expansion and Improvement

The concept of GMDSS expansion and improvement that should be executed as an urgent project is as follows:

(1) Expansion of GMDSS Coverage

a. To cover major blind waters by MF DSC for Sea Area A2

b. To cover waters in and around main ports and important navigation waters by VHF DSC for Sea Area A1

(2) Commencement of National NAVTEX service

a. To introduce and commence National NAVTEX service in Indonesian language using a frequency and transmitters for existing International NAVTEX

(3) Improvement of coast stations for enabling them to cover GMDSS

a. To improve the coast stations having problems in order to enable them to secure GMDSS coverage

21.4. Contents of the Project

21.4.1. Expansion of GMDSS Coverage

(1) Sea Area A2 by MF DSC

The following existing stations should be installed with MF DSC to cover major blind zones.

1st class : 1 station
2nd class : 3 stations
3rd class : 2 stations
4th class : 13 stations

Figure 21.3. shows the expansion coverage for Sea Area A2.

(2) Sea Area A1 by VHF DSC

The following existing stations should be installed with VHF DSC to cover around main ports and important navigation waters.

1st class : 1 station
2nd class : 3 stations
3rd class : 5 stations
4th class : 24 stations

Figure 21.4. shows the expansion coverage for Sea Area A1.

21.4.2. Commencement of National NAVTEX

The 1st stage of National NAVTEX service in Indonesian language will be commenced using the transmitters and the frequency of the present International

NAVTEX stations (Jakarta, Makassar, Ambon and Jayapura).

The coverage areas of National NAVTEX using 518 kHz is the same coverage as existing International NAVTEX and shown in **Figure 21.2.**

21.4.3. Improvement of Coast Stations for enabling them to cover GMDSS

The following improvement for coast stations should be executed urgently in synchronization with the project of GMDSS expansion:

(1) Separation of transmitting and receiving station
Teluk Bayur (2nd class)
Benoa (3rd class)

(2) Improvement of environment for coast stations
Surabaya (1st class)
Makassar (1st class)

(3) Improvement of VHF coverage
Dumai (1st class)
Samarinda (3rd class)

(4) Improvement of engine-generators
1st and 2nd class stations

(5) Replacement of old antennas
1st and 2nd class stations

All the items planned in urgent project and its related stations are shown in **Table 21.2.**

21.4.4. Establishment of Comprehensive Maintenance Function

In order to cope with the increase of sophisticated equipment, comprehensive maintenance function should be established in Jakarta, which intends to reinforce practical and effective maintenance system for maritime telecommunication system with fully prepared spare parts, maintenance goods, personal computer (PC) networks with $1^{st}/2^{nd}$ coast stations, etc and high-level staffs.

21.4.5. Reinforcement of Training Function

Present training equipment installed at Tg. Priok, Jakarta is mainly for the staffs at the 1st and 2nd class coast stations. According to extensive deployment of numbers of different types of equipment for GMDSS and other communication

purposes, necessity of practical training on operation and maintenance for whole DGSC's coast stations has been significantly increase.

Therefore, a comprehensive training function should be established, introducing all-round of equipment, instruction materials, simulators, etc. in addition to the present equipment.

21.5. Review of the Classification and the Operation-hours of Coast Stations

The 221 coast stations of DGSC are classified into 5 classes: Ⅰ, Ⅱ, Ⅲ, Ⅳ-a and Ⅳ-b by service type and operating hour.

In parallel with the enforcement of GMDSS, the classification and the operating hours of coast stations are recommended to review. Thereby, increase and/or reshuffle of stations staffs will be needed.

21.6. Implementation Schedule

Implementation time of this Project is estimated for 50 months and the schedule is shown in **Table 21.3.**

21.7. Project Cost Estimate

Implementation costs for expansion and improvement of GMDSS are estimated as follows:

a. Expansion of A2 and A1	:	US$ 22,014,300
b. National NAVTEX	:	(not required)
c. Improvement of Coast stations	:	US$ 17,787,000
Total		US$ 39,801,300

21.8. Operation and Maintenance Cost

All of GMDSS equipment will be installed at existing coast stations. Accordingly, most proportion of running cost is for repairing including provision of spare parts/units and electricity/fuel, and the total running cost of this project is estimated US$ 360,000 per year.

Figure 21.3. GMDSS Coverage Area (A2, Expansion)

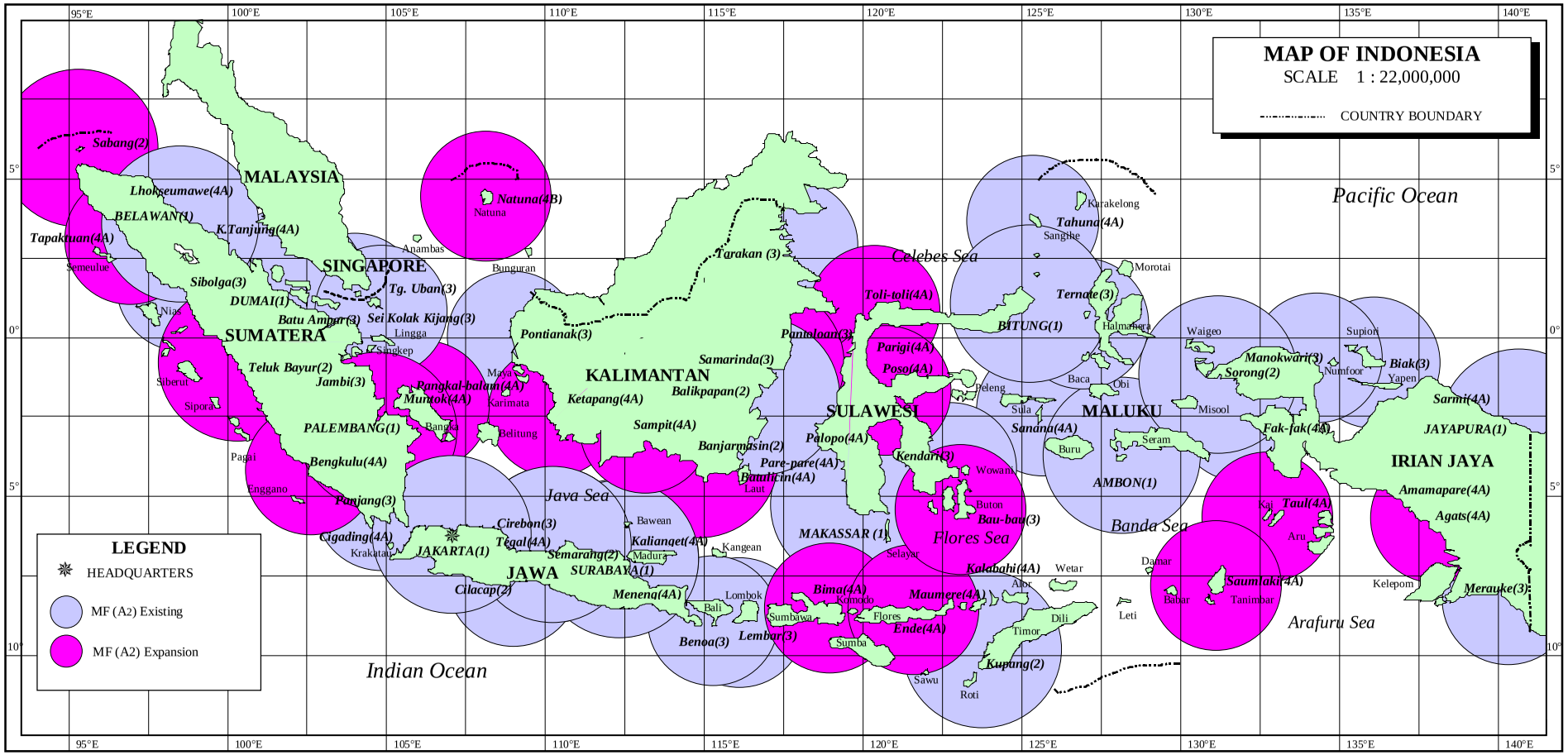


Figure 21.4. GMDSS Coverage Area (A1, Expansion)

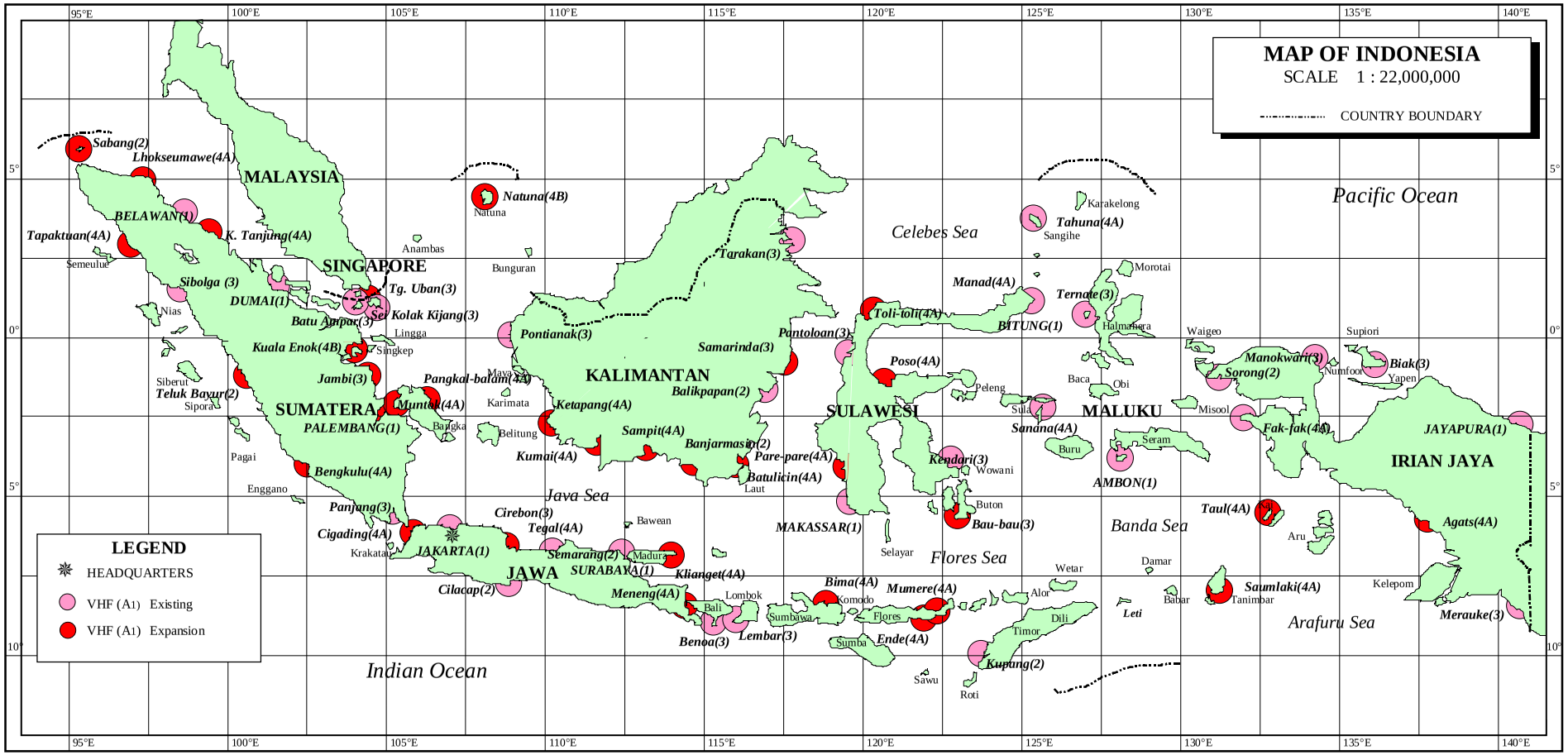
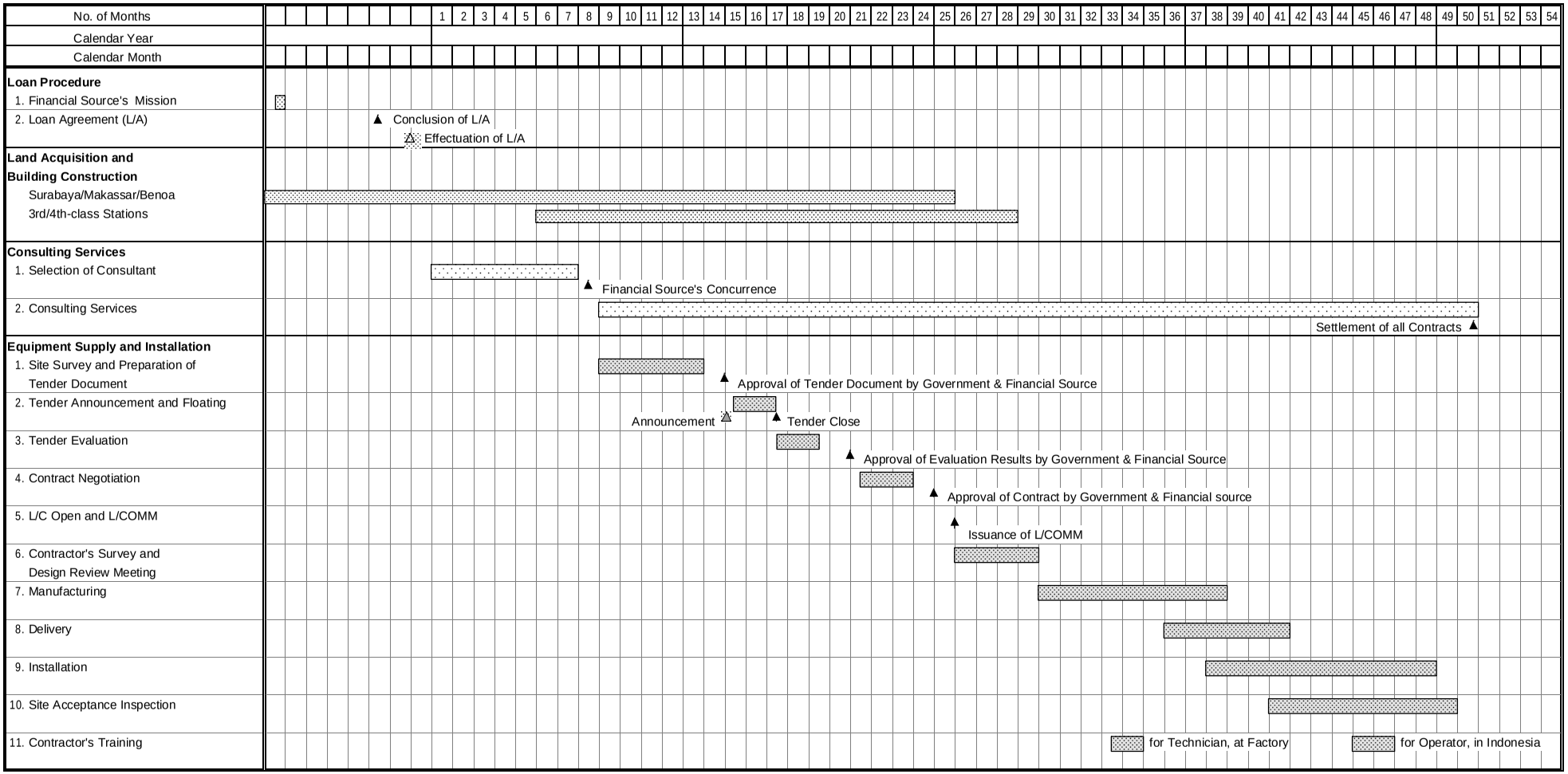


Table 21.2. Expansion and Improvement Plan for GMDSS

Class		Name	A3	A2	A1	NAVTEX		Improvement				
			HF DSC	MF DSC	VHF DSC	International	National	Separation	Relocation	VHF Area	E/G	Antenna
I	1	Belawan	▲	▲	▲						◎	◎
	2	Dumai	▲	▲	▲					◎	◎	◎
	3	Palembang		◎	◎						◎	◎
	4	Jakarta	▲	▲	▲	▲	◎				◎	◎
	5	Surabaya	▲	▲	▲				◎		◎	
	6	Makasar	▲	▲	▲	▲	◎		◎		◎	
	7	Bitung	▲	▲	▲						◎	◎
	8	Ambon	▲	▲	▲	▲	◎				◎	◎
	9	Jayapura	▲	▲	▲	▲	◎				◎	◎
II	1	Sabang		◎	◎						◎	◎
	2	Teluk Bayur		◎	◎			◎				
	3	Semarang	▲	▲	▲						◎	
	4	Cilacap		▲	▲							
	5	Kupang	▲	▲	▲							◎
	6	Banjarmasin		◎	◎						◎	◎
	7	Balikpapan	▲	▲	▲						◎	◎
	8	Sorong	▲	▲	▲						◎	◎
III	1	Sibolga		▲	▲							
	2	Batu Ampar		▲	▲							
	3	Tg. Uban			◎							
	4	Sei Kolak Kijang		▲	▲							
	5	Jambi			◎							
	6	Panjang		▲	▲							
	7	Cirebon			◎							
	8	Benoa		▲	▲			◎				
	9	Lembar		▲	▲							
	10	Pontianak		▲	▲							
	11	Samarinda		◎	◎					◎		
	12	Tarakan		▲	▲							
	13	Kendari		▲	▲							
	14	Bau-bau		◎	◎							
	15	Pantoloan		▲	▲							
	16	Ternate		▲	▲							
	17	Manokwari		▲	▲							
	18	Biak		▲	▲							
	19	Merauke		▲	▲							
IV	1	Tapaktuan		◎	◎							
	2	Kuala Tanjung			◎							
	3	Lhokseumawe			◎							
	4	Kuala Enok			◎							
	5	Natuna		◎	◎							
	6	Muntok			◎							
	7	Pangkal Balam		◎	◎							
	8	Bengkulu		◎	◎							
	9	Cigading			◎							
	10	Kalianget			◎							
	11	Meneng (Banyuwangi)			◎							
	12	Bima		◎	◎							
	13	Ende		◎	◎							
	14	Maumere			◎							
	15	Ketapang		◎	◎							
	16	Sampit		◎	◎							
	17	Kumai			◎							
	18	Batulicin			◎							
	19	Pare-pare			◎							
	20	Poso		◎	◎							
	21	Toli-toli		◎	◎							
	22	Tahuna		▲	▲							
	23	Tual		◎	◎							
	24	Saumlaki		◎	◎							
	25	Sanana		▲	▲							
	26	Fak-fak		▲	▲							
	27	Agats		◎	◎							
Total Existing			12	30	30	4	-					
Total Expansion (Urgent)			**-**	**19**	**33**	**-**	**4**	**2**	**2**	**2**	**14**	**12**
Grand Total			12	49	63	4	4	2	2	2	14	12

Note: ▲ Existing
◎ **New (Urgent)**

Table 21.3. Implementation Time Schedule for GMDSS



21.9. Economic Analysis

Purpose of GMDSS is to establish the distress and safety communication system in Indonesian waters. GMDSS was put into service in February 1992 and fully implemented in February 1999 according to the regulations under SOLAS Convention and mandatory system for vessels.

By expansion and improvement of GMDSS, effects are analyzed as follows;

* Increasing probability of rescue
* Increasing navigational safety
* Decreasing search costs for ships in distress
* Decreasing social unrest due to incorrect information

Costs are analyzed as follows;

* Occurrence of installation costs
* Increasing rescue costs due to mishandling of the equipments
* Occurrence of education and training costs
* Campaign costs to the public

Considering effects, the items are very hard to convert into currency as benefits. But it has potential for saving human lives at sea and navigational safety. A lot of human lives have been lost every year in Indonesian waters by serious marine accidents. These accidents especially pointed out the lack of maritime telecommunication system. The effects for decreasing loss of human lives and increasing navigational safety are worth the projects costs.

21.10. Financial Analysis

(1) Purpose

For this project, light dues will be available to cover the operation and maintenance cost. The financial analysis has been assessed in terms of FIRR (Financial Internal Rate of Return).

(2) Raising funds for investment

(ODA loans)

a. 15% of total amount of investment (foreign cost + local cost) should be paid from funds of GOI as a down payment.

b. 85% of total amount of investment (foreign cost + local cost) should be loaned to GOI.

c. Loan period is 30 years, grace period of the principal is 10 years and interest rate is 1.8%.

(Market Rate)

a. 15% of total amount of investments (foreign cost + local cost) should be paid from funds of GOI as a down payment.

b. 85% of total amount of investments (foreign cost + local cost) should be loaned to GOI.

c. Loan period is 10 years and interest rate is 6 %.

(3) Calculation for revenue

Light dues shall be applied to civil works, facilities, machineries, consulting services and other project needs including operating cost, maintenance cost.

According to Communication Bureau of BAPPENAS, 50 % of light dues would be used for aids to navigation, supporting facilities and maritime telecommunication system.

(4) Consideration of FIRR

(ODA loan)

Necessary light dues to achieve 1.8% of FIRR (GDP: Likeliest Case) are 10.49 % of light dues for 30 years of loan period.

(Market Rate)

Necessary light dues to achieve 6.0 % of FIRR (GDP: Likeliest Case) are 32.40 % of light dues for 10 years of loan period.

CHAPTER 22.
INDONESIA SHIP REPORTING SYSTEM

22.1. Introduction

"International Convention on Maritime Search and Rescue (SAR Convention) 1979" which has become effective since 1985, recommends a contracting Government to establish a ship reporting system for application within its search and rescue region for which it is responsible, where this is considered necessary to facilitate search and rescue operations and is deemed practicable.

In Asia-Pacific region, many systems have been established and operated, such as AMVER (United States), AUSREP (Australia), JASREP (Japan), INSPIRES (India), STRAITREP (The Strait of Malacca and Singapore), KOSREP (Korea) and CHISREP (China), and these have greatly contributed to maritime safety, especially in the sea areas of less rescue forces.

Ship reporting systems are in these days used to provide data for many purposes, not only for search and rescue but also for preventing marine pollution, countermeasures against crimes at sea, etc.

Considering that the Republic of Indonesia, as a big maritime state in the world, has a vital responsibility for ensuring maritime safety and protecting marine environment, Indonesia Ship Reporting System should be planned and implemented as early as possible.
This system is recommended to be introduced separately in two stages as follows:

[1st stage]
Existing DSC/NBDP at major coast stations (1st, 2nd and 3rd class) should be utilized.
In addition, Automatic Identification System (AIS), using VHF and to be installed on vessels from 2002, should be introduced at the 1st and the 2nd class coast stations in order to adopt an automatic position-detecting system.

[2nd stage]
The introduction of AIS using VHF should be expanded to the 3rd class coast stations.
In addition, application of a long range AIS which is now under technological study at International Telecommunication Union (ITU), will be utilized.

22.2. Necessity of Ship Reporting System

(1) A Ship Reporting System plays an important role in maritime search and rescue in conjunction with distress and safety communication system by GMDSS.

SAR Convention which has become effective since 1985 recommends a contracting Government to establish a ship reporting system for application within its search and rescue region.

(2) In Asia-Pacific region, many systems have been established and operated, such as AMVER (United States), AUSREP (Australia), JASREP (Japan), INSPIRES (India), STRAITREP (The Strait of Malacca and Singapore), KOSREP (Korea) and CHISREP (China), and these have greatly contributed to maritime safety, especially in the sea areas of less rescue forces.

(3) Ship reporting systems are in these days used to provide data for many purposes, not only for search and rescue but also for preventing marine pollution, countermeasures against crimes at sea, etc.

After the simultaneous multi-terrorism in the Unite States on 11 September 2001, Japanese Government is encouraging expanded ship reporting, considering that there will be threat to ships such as terrorism and piracies hereafter.

(4) In the Straits of Malacca and Singapore and Indonesian archipelagic sea lanes, there are many transiting vessels for international transportation, and many passenger and cargo vessels for coastal and inter-island shipping. This means Indonesian waters are in good surroundings to give and get mutual assistances by navigating vessels.

(5) The Republic of Indonesia, as a big maritime state in the world, has a vital responsibility for maritime SAR operation and preventing marine pollution, but vessels for SAR operation are extremely insufficient in quantity and quality.

Therefore, in many cases of marine accidents, SAR authorities have to request for assistance to nearby navigating vessels.

(6) A lot of human lives have been lost every year in Indonesian waters by serious marine accidents.

A Ship Reporting System gives a quick and maximum assistance to a ship in distress and contributes to the decrease of victims at sea.

As Indonesian waters have moderate temperature and calm sea, persons in

waters can live longer. Therefore, the introduction of a Ship Reporting System may greatly contribute to the rescue for distress persons.

(7) As DGSC owns many coast stations throughout Indonesia, Indonesia Ship Reporting System can be established with low cost and in short term using these existing coast stations.

At the first stage,

- Existing DSC/NBDP at major coast stations (1st, 2nd and 3rd class) should be utilized.
- In addition, Automatic Identification System (AIS) using VHF which will be installed on vessels from 2002 should be introduced at the 1st and 2nd class stations in order to adopt an automatic position-detecting system.

(8) Budget from the Light Dues has been allotted to DGSC from 2001, thereby the maintenance and training fee for the maritime telecommunication system have been substantially increased and the maintenance conditions will be greatly improved hereafter.

22.3. Concept of Indonesia Ship Reporting System

(1) System's Name

Indonesia Ship Reporting System is tentatively called INDOSREP.

(2) Area to be covered

Indonesian Search and Rescue Region (SRR) shown in **Figure 22.1.** will be suggested as a reporting area in accordance with SAR Convention.

However, this area is too complicated and does not seem to be practical for a ship reporting system. Therefore, further study including negotiations with neighboring countries is required to make a practical reporting area.

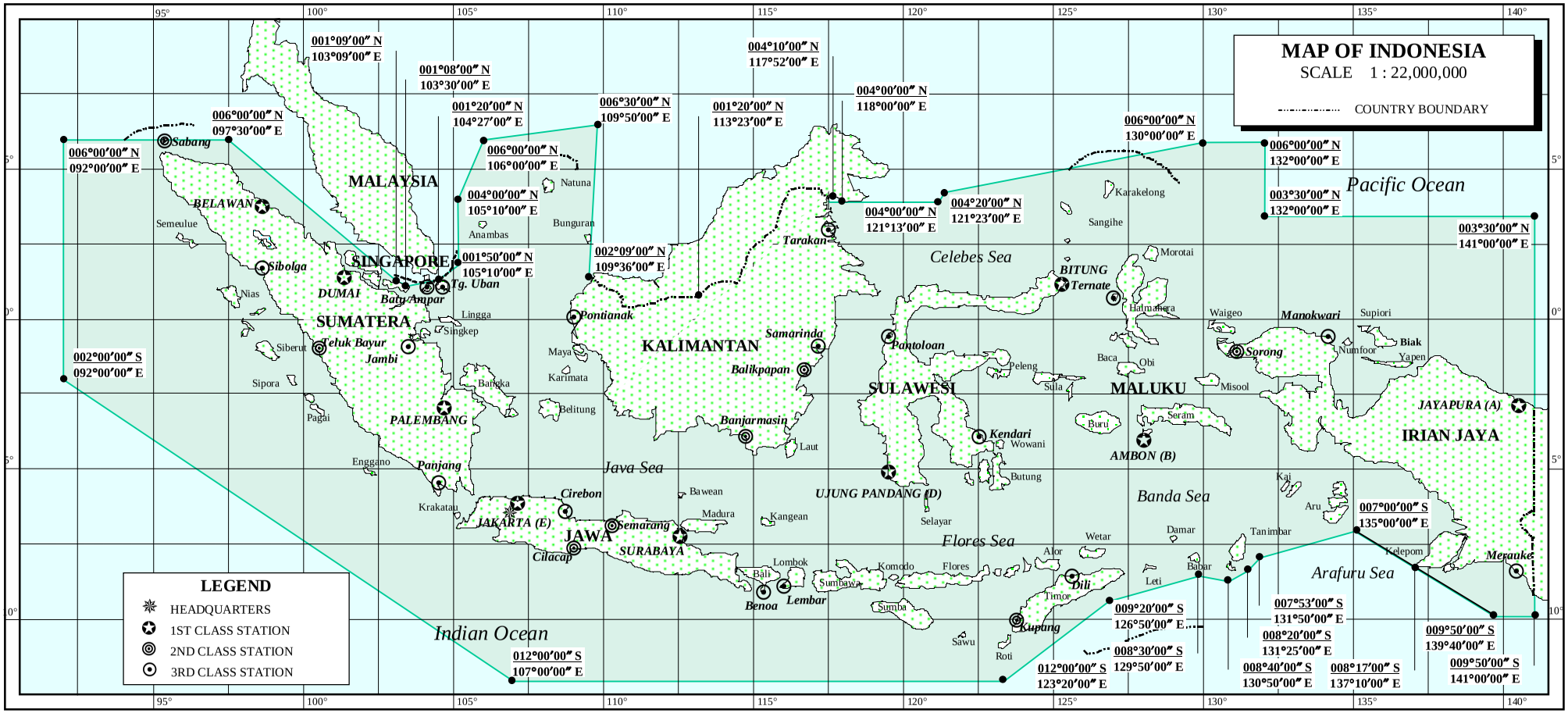
(3) Participating Ships

Basically, any kinds of vessels regardless of nationality are welcomed. Further study for categories on participating ships, based on relevant various regulations and current situation of maritime traffic, is required.

(4) Type of Report

The following reports are recommendable from the IMO Resolution A.851 (20):

Figure 22.1. Area of Ship Reporting System in Indonesia (for Example, by SRR)



General Reports;

① Sailing plan (SP)
② Position report (PR)
③ Deviation report (DR)
④ Final report (FR)

Special Reports;

① Dangerous goods report (DG)
② Harmful substances report (HS)
③ Marine pollutants report (MP)

(5) Reporting Interval

Basically within 24 hours. But further study, based on the features of an archipelagic Indonesian waters and the current situation of maritime traffic, is required.

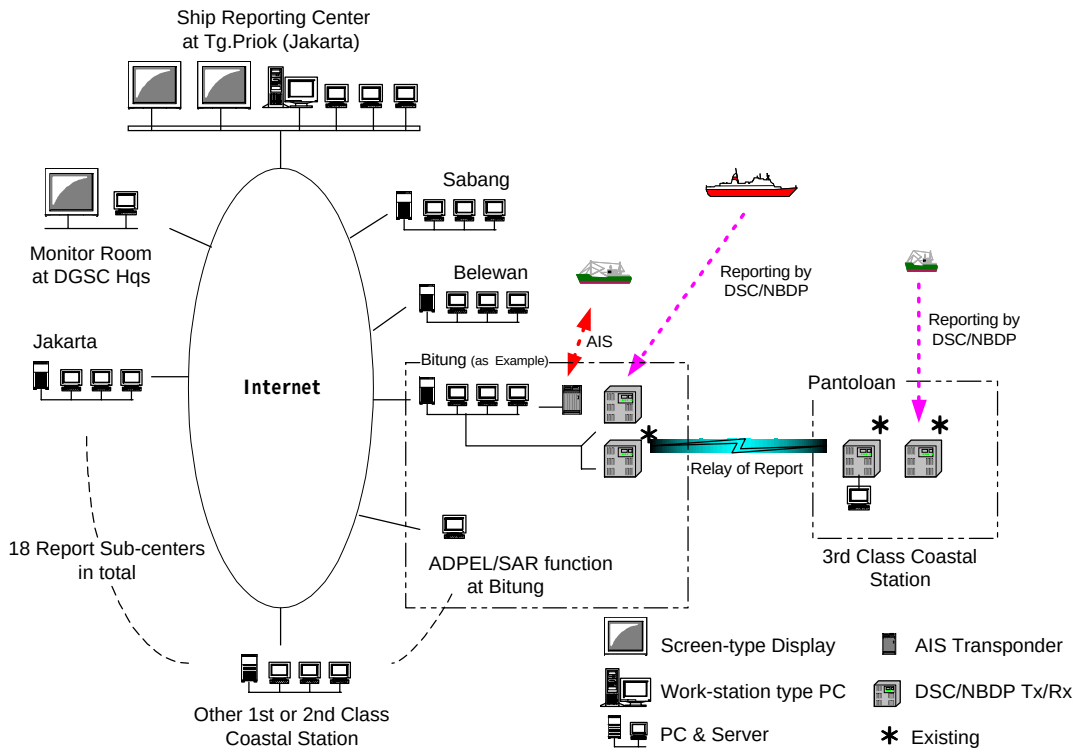
(6) Implementing Authority

Directorate General of Sea Communication, Ministry of Communication

22.4. Contents of the Project

Major system composition of INDOSREP is Report Receiving Stations, Report Sub-Centers, Ship Reporting Center and data transmission lines. The System composition is shown in **Figure 22.2.**

Figure 22.2. System Configuration of INDOSREP



(1) Report Receiving Stations

Report Receiving Stations（Receiving Stations）will be set up at the major coast stations (1st, 2nd and 3rd class).

The Receiving Stations receive reports from participating ships by;

HF DSC/NBDP : 1st and 2nd stations
MF DSC/NBDP : 1st, 2nd and 3rd stations
VHF AIS : 1st and 2nd stations
INMARSAT, e-mail and other public networks

The 3rd class station sends the reports to each Report Sub-Center after receiving.

(2) Report Sub-Centers

Report Sub-Centers (Sub-Centers) will be set up at 1st class and 2nd class coast stations.

Sub-Centers collect reports directly from participating ships or the 3rd class coast stations, and send the data to Ship Reporting Center in Jakarta. Also, Sub-Centers receive processed data from Ship Reporting Center and send the data to ADPEL and other SAR related organizations as needed.

(3) Ship Reporting Center

Ship Reporting Center (Center) will be set up at transmitting site of Jakarta coast station, Tg. Priok.

Center collects, processes, analyzes and stores various reports received from Sub-Centers or directly from ships through INMARSAT and other public networks. Also, Center sends the processed data to Sub-Centers, and to DGSC, ARMADA PLP and SAR related organizations as needed.

(4) Data transmission lines

Telecommunication line for reports transmission on land is as follows:

Center ~ Sub-Centers : Internet / Existing HF
Sub-Centers ~ 3rd class stations : Existing HF

Figure 22.3. and **Table 22.1.** show the project site of INDOSREP.

22.5. Preparation for the Project

In advance of the establishment of a Ship Reporting System, ① Area to be

covered, ② Participating ships, ③ Type of reports, ④ Reporting interval, ⑤ Operation scheme and rules, etc. should be clarified, taking account of various relevant regulations, maritime traffic and negotiations with neighboring countries with the following cooperation from a Ship Reporting implementing country:

(1) Training and guidance by an expert in charge of operation from an implementing country ---------- 12 months

(2) Training and guidance by an expert (technician) from an implementing country ---------- 2~3 months

(3) Study at an implementing country by several DGSC officials in charge of operation and technology ---------- 2~3 months

22.6. Setting up of Executing Organization

Indonesia Ship Reporting Center will be set up at Tg.Priok which will execute the whole tasks on management, operation and maintenance for Indonesia Ship Reporting System.

22.7. Implementation Schedule

Implementation time of this Project is estimated for 42 months and the schedule is shown in **Table 22.2.**

22.8. Project Cost Estimate

Implementation costs for establishment of Indonesia Ship Reporting System are estimated as follows:

a. Center	:	US$ 1,778,700
b. Sub-Center (1st & 2nd class stations)	:	US$ 9,355,500
c. 3rd class stations	:	US$ 314,160
Total		US$ 11,448,360

22.9. Operation and Maintenance Cost

Most equipment for INDOSREP will be installed at existing coast stations. Accordingly, most proportion of running cost is for repairing including provision of spare parts/units and electricity/fuel, and the total running cost of this Project is estimated US$ 138,600 per year.

Figure 22.3. Project Sites of Ship Reporting System

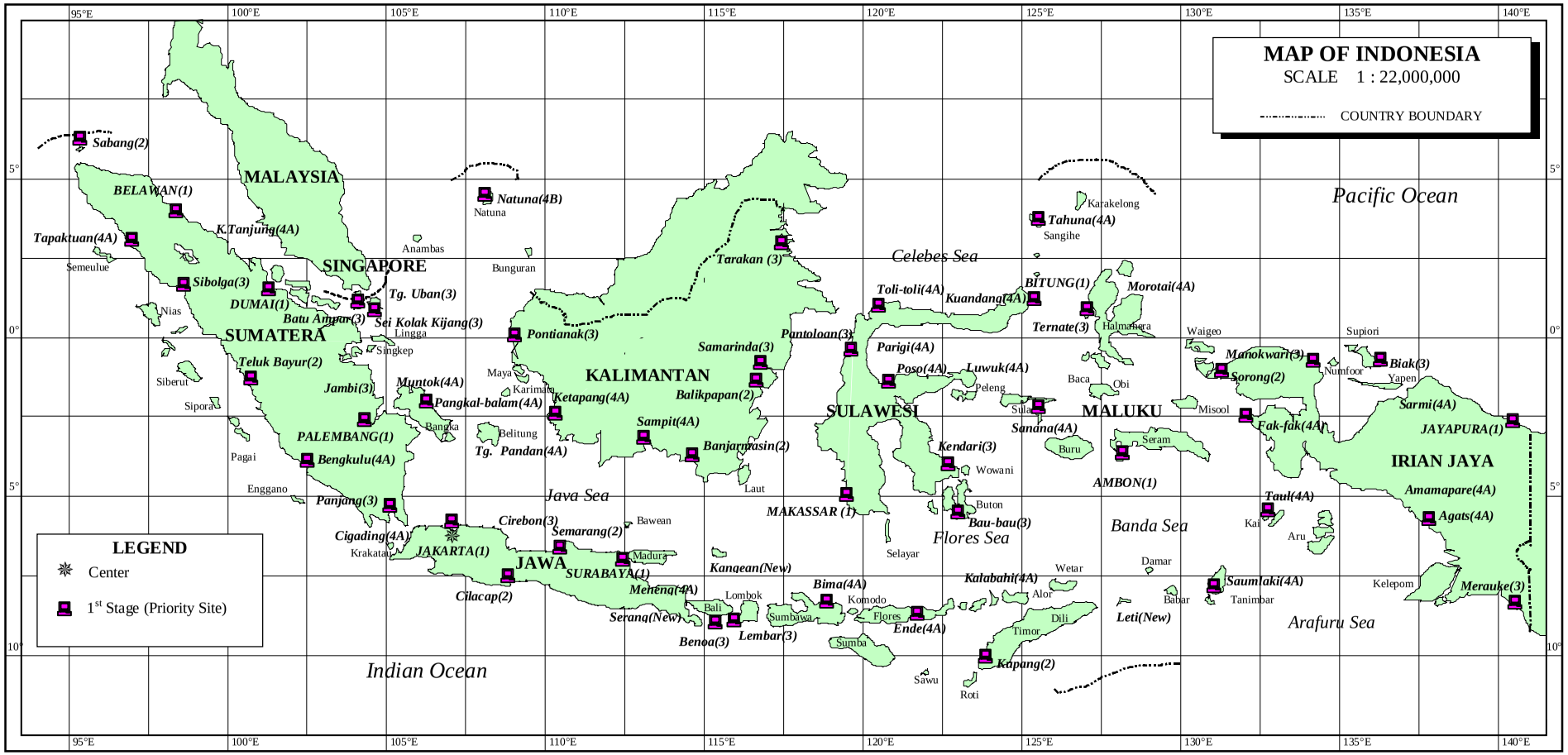
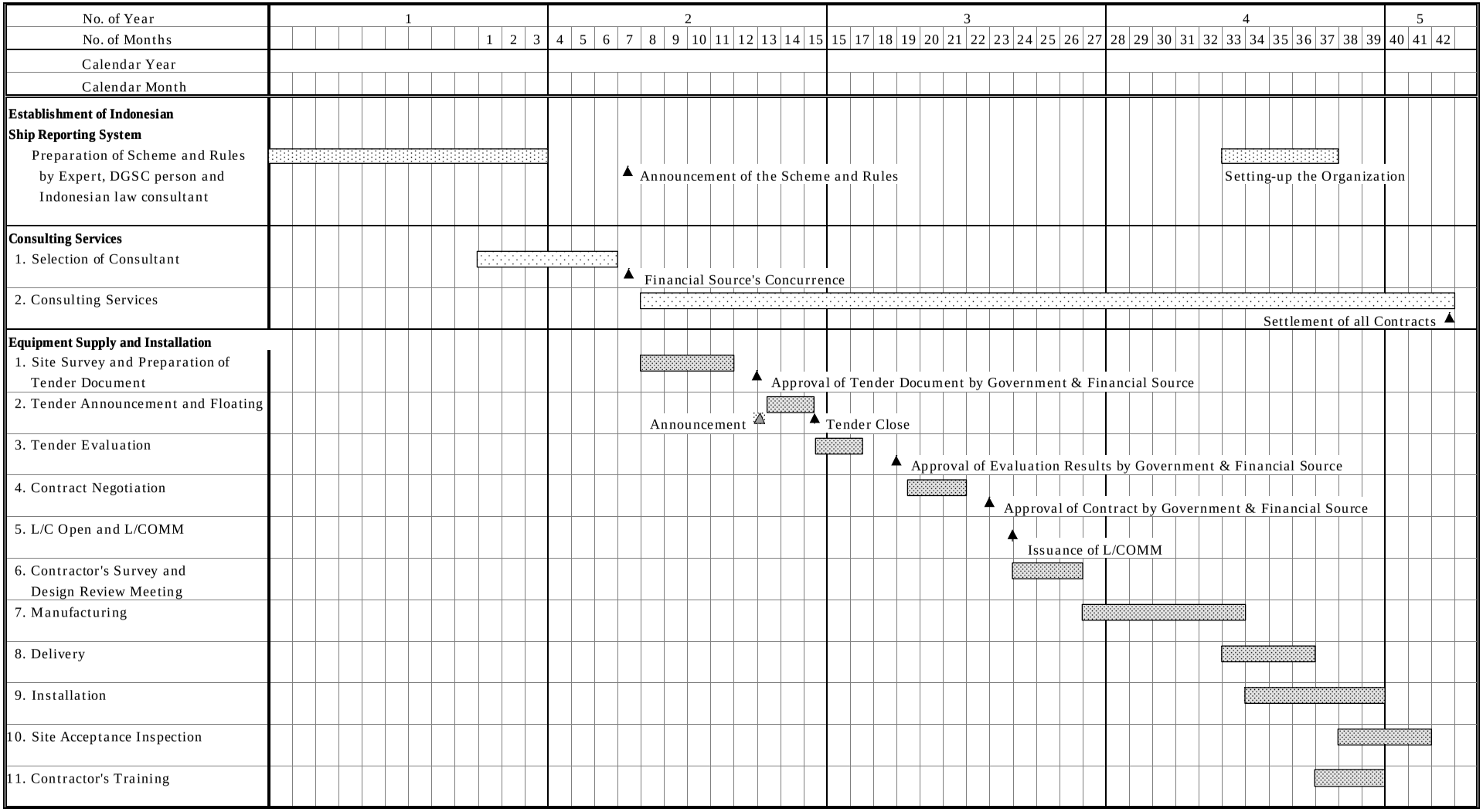


Table 22.1. Establishment Plan for Ship Reporting System

Class		Name	Center	Sub-center	Controlling & Monitoring	(A3) HF DSC/NBDP	(A2) MF DSC/NBDP	(A1) VHF AIS
		Center (at Tg. Priok)	○		◎			
		Monitor Room (at HQ)			◎(Monitoring)			
I	1	Belawan		○		◎	◎	◎
	2	Dumai		○		◎	◎	◎
	3	Palembang		○			◎	◎
	4	Jakarta		○		◎	◎	◎
	5	Surabaya		○		◎	◎	◎
	6	Makasar		○		◎	◎	◎
	7	Bitung		○		◎	◎	◎
	8	Ambon		○		◎	◎	◎
	9	Jayapura		○		◎	◎	◎
II	1	Sabang		○			◎	◎
	2	Teluk Bayur		○			◎	◎
	3	Semarang		○		◎	◎	◎
	4	Cilacap		○			◎	◎
	5	Kupang		○		◎	◎	◎
	6	Banjarmasin		○			◎	◎
	7	Balikpapan		○		◎	◎	◎
	8	Sorong		○		◎	◎	◎
III	1	Sibolga					◎	
	2	Batu Ampar					◎	
	3	Sei Kolak Kijang					◎	
	4	Panjang					◎	
	5	Benoa		○			◎	◎
	6	Lembar					◎	
	7	Pontianak					◎	
	8	Samarinda					◎	
	9	Tarakan					◎	
	10	Kendari					◎	
	11	Bau-bau					◎	
	12	Pantoloan					◎	
	13	Ternate					◎	
	14	Manokwari					◎	
	15	Biak					◎	
	16	Merauke					◎	
IV	1	Tapaktuan					◎	
	2	Natuna					◎	
	3	Pangkal Balam					◎	
	4	Bengkulu					◎	
	5	Bima					◎	
	6	Ende					◎	
	7	Ketapang					◎	
	8	Sampit					◎	
	9	Poso					◎	
	10	Toli-toli					◎	
	11	Tahuna					◎	
	12	Tual					◎	
	13	Saumlaki					◎	
	14	Sanana					◎	
	15	Fak-fak					◎	
	16	Agats					◎	
Total (1st Stage)					**2**	**12**	**49**	**18**

Table 22.2. Implementation Time Schedule for Ship Reporting System



22.10. Economic Analysis

The primary reason of the selection for ship reporting system is that International Convention on Maritime Search and Rescue, 1979 (SAR Convention) recommends to establish it.

By the development of ship reporting system, effects are analyzed as follows:

- Increasing probability of rescue
- Increasing navigational safety
- Decreasing search costs for ships in distress
- Increasing marine environmental protection

Costs are analyzed as follows:

- Occurrence of installation costs
- Occurrence of education and training costs
- Campaign costs to the public

Considering effects, the items are very hard to convert into currency as benefits. But it has fairly strong effects for saving human lives at sea, navigational safety and environmental protection. A lot of human lives have been lost every year in Indonesian waters by serious marine accidents. Ship reporting system will contribute to the above effects. The effects for decreasing loss of human lives and increasing navigational safety are worth the projects costs.

22.11. Financial Analysis

(1) Purpose

For this project, light dues will be available to cover the operation and maintenance cost. The financial analysis has been assessed in terms of FIRR (Financial Internal Rate of Return).

(2) Raising funds for investment

(ODA loan)

a. 15% of total amount of investment (foreign cost + local cost) should be paid from funds of GOI as a down payment.
b. 85% of total amount of investment (foreign cost + local cost) should be loaned to GOI.
c. Loan period is 30 years, grace period of the principal is 10 years and interest rate is 1.8%.

(Market Rate)

a. 15% of total amount of investments (foreign cost + local cost) should be paid from funds of GOI as a down payment.
b. 85% of total amount of investments (foreign cost + local cost) should be loaned to GOI.
c. Loan period is 10 years and interest rate is 6 %.

(3) Calculation for revenue

Light dues shall be applied to civil works, facilities, machineries, consulting services and other project needs including operating cost, maintenance cost.

According to Communication Bureau of BAPPENAS, 50 % of light dues would be used for aids to navigation, supporting facilities and maritime telecommunication system.

(4) Consideration of FIRR

(ODA loan)

Necessary light dues to achieve 1.8% of FIRR (GDP: Likeliest Case) are 3.00 % of light dues for 30 years of loan period.

(Market Rate)

Necessary light dues to achieve 6.0 % of FIRR (GDP: Likeliest Case) are 8.14 % of light dues for 10 years of loan period.

CONCLUSION AND RECOMMENDATIONS

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1. Aids to navigation and maritime telecommunication system in Indonesia have not been properly maintained and managed with their facilities and equipments for such reason as shortage of budget and lack of technological skills. Improvement and replacement are necessary for a wide variety of fields all over the country. At the same time, introduction of new system is an important task with the progress of internationalization.

2. Under these circumstances, the Light Dues System has been introduced. Thanks to the system, it is expected that the dues will greatly improve maintenance and management of aids to navigation and maritime telecommunication system. The amount to be used for the above is about 50% of all the revenue from the light dues.

3. The Master Plans on the Maritime Traffic Safety System Development in Indonesia were formulated up to the target year of 2020 based on the above background. GMDSS, Aids to Navigation, VTS and Ship Reporting System were finally selected as the Priority Projects from the Short Term Plans. To implement these projects, it is expected to promote the social economic progress along with the Light Due System. In addition, Indonesia, as one of the largest archipelagic and maritime states, will perform international duties and contribute to the development and improvement of the national land.

4. On the other hand, routine budget is still in a difficult condition owing to the economic crisis, although it shows a signal of recovering, and the share of the light dues is not always enough. The above projects are recommended as the priority projects and should be urgently implemented. However, in consideration of the budget condition, all the efforts should be made for the increase of budget and the light dues revenue, and the projects must be implemented one after another.

5. The Republic of Indonesia was recognized as an archipelagic state based on UNCLOS in 1994, and three sea lanes were approved also in accordance with the Convention. Under these circumstances, it has become important duties for Indonesia to observe and implement related international conventions and regulations such as UNCLOS and SOLAS Convention.

6. According to SOLAS Convention, GMDSS has been introduced since 1992 and fully implemented in February 1999. Accordingly, most countries have already completed shore-based facilities and they are in full operation. DGSC, so far, has

equipped 30 coastal radio stations with GMDSS but there still remain a lot of blind waters.

7. As one of the world largest maritime countries, Indonesia has a grave responsibility for the establishment of distress and safety communication system at sea in accordance with SOLAS Convention and related international regulations. For these reasons, GMDSS should be established and implemented firstly and urgently.

8. Aids to navigation are the facilities of infrastructure for marine traffic safety. The best merit of aids to navigation for users is that they do not need any specific equipment. They are practical facilities that can contribute to the safety of vessels navigating coastal waters and their economical and efficient operations. Following GMDSS, each aid to navigation should be developed and improved. It is necessary that VTS and Ship Reporting System should be established considering the progress of the above.

9. DGPS provides users with higher positioning accuracy of GPS and completeness and reliability of positioning information. When DGPS is combined with AIS and Electronic Nautical Charts to be introduced in the near future, its availability will be further increase. For this reason, DGPS should be utilized as a system for increasing positioning accuracy and reliability in the waters such as narrow channels and traffic congested waters. Therefore, the urgency of DGPS has been judged low and removed from the Priority Projects.

10. In consideration of the above, the Priority Projects should be urgently implemented. The initial investment cost for the Priority Projects amounts to 82.171 million US$ and operating/maintenance cost for 30 years amounts to 68.134 million US$, thence, the required cost for 30 years amounts to 150.305 million US$. Assuming that revenue of light dues grows according to the GDP likeliest growth rate (6.5% of yearly growth rate after year 2003.), the total fund for 30 years for the Priority Projects should be yearly refunded by **21.93%** of yearly light due revenue based on **1.8 %** of ODA loan interest, and **46.30%** of that based on **6.0%** of average market interest.

11. In addition, in order to implement the above Projects effectively and properly, it is recommendable to improve " Maintenance and Management System", to establish "Education and Training System", to correctly grasp "Marine Accidents", to strengthen "SAR System" and to carry out "Marine Traffic Density Survey".

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