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

MAIN REPORT VOLUME 2

PART 2. : MASTER PLANS AND RECOMMENDATIONS

June 2002

THE JAPAN ASSOCIATION OF MARINE SAFETY (JAMS)

JAPAN AIDS TO NAVIGATION ASSOCIATION (JANA)

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Exchange Rate in the Study:

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(**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

川上隆朗

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,

津田真吾

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

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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
	DPOD	Dewan Pertimbangan Otonomi Daerah / Local Autonomy Consulting Committee
	DSC	Digital Selective Call
	DSI	Daftar Suar Indonesia (List of Lights in Indonesia)
	DWT	Dead Weight Tonnage
E	E/G	Engine Generator
	EIRR	Economic Internal Rate of Return
	ECDIS	Electronic Chart Display Information System
	ECS	Electronic Chart System
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
	Gs	Gosong (Sandbar)
	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
	KKN	Kolusi, Korupsi dan Nepotism / Collution, Corruption and Nepotism
	KM	Minister Decree
L	LAN	Lembaga Administrasi Negara / National Institute of Administration
	lat. or Lat.	Latitude
	LF	Low Frequency
	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)
	PROPENAS	National Development Program
	PT.	Perseroan Terbatas (Corporation)
	PUMDA	Pekerjaan Umum Daerah
	PUOD	Pemerintah Umum dan Otonomi Daerah
R	RACON	Radar Beacon
	RC	Reinforced Concrete
	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
	RTCM	Radio Technical Communication for Maritime Services
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
	SWL	Safe Working Load
T	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
	2drm	2 distance-root-mean-squares

CHAPTER 1.

MASTER PLAN S UP TO YEAR 2020

CHAPTER 1.
MASTER PLANS UP TO YEAR 2020

1.1. Visual Aids to Navigation

1.1.1. Basic Approach

The basic role of aids to navigation is to keep safety and to promote traffic efficiency for ships navigation by providing them with accurate positions.
It is necessary for safe and economical navigation that visual aids to navigation which are recognized by visual perception of mariners should be maintained with sufficient number and reliability.

The most desirable arrangement for aids to navigation will be such that the highest rate of availability exists regardless of the number of ships using them. Namely, allocation of visual aids to navigation facilities should be so arranged that cross bearing may be obtained within 10 nautical miles in the waters along Indonesian coasts.

The formulation of master plan up to year 2020 for visual aids to navigation is planned, however, the following points should be considered in the actual practice due to various restrictions of economic, technical and local requirements.

Master plan up to year 2020 is formulated in consideration of the following points and considered economical, technical aspects and local requirement.

- 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
- Consideration of aids to navigation in Indonesian waters that Malacca Strait Council has installed, renewed and maintained.

The designated traffic routes of tankers, passenger ships, pioneer service ships, container ships, general (bulk) cargo ships are shown in **Figure 1.1.1. ～ Figure 1.1.5.** respectively.
The locations of marine casualties from 1992 to 2000 are shown in **Figure 1.1.6.**
The locations of commercial ports and non-commercial ports, main ports under SISTRANAS and DGSC strategic ports are shown in **Figure 1.1.7. ～ Figure**

1.1.9. respectively.

These figures are applied for site selection and confirming criteria for making Master Plan.
Nautical chart is used to confirm dangerous area (approach channels and coral reef etc.).

The master plan of visual aids to navigation should be formulated on the two (2) categories consisting of "Rehabilitation and improvement of Visual Aids to Navigation" and "Development of Visual Aids to Navigation" in consideration of the above.

All aids to navigation should be confirmed on appropriateness under IALA recommendation.

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 in Indonesian waters should be reflected on this Master Plan after due consideration, if necessary.

The followings are applied for the formulation of the Master Plan;

(1) Types of visual aids to navigation

The types of visual aids to navigation are categorized as follows;

① Lighthouse as a fixed mark. The light is of major importance and has one or more resident lighthouse keepers.

② Light beacon as a fixed mark including leading light, sector light and resilient light beacon. The lights are operated automatically and kept in service with routine maintenance.

③ Light buoy as a floating mark which is anchored by mooring system.

④ Others (Un-lighted beacon and un-lighted buoy) as day marks

(2) Purposes of visual aids to navigation by type

In this master plan, the purposes of each visual aids to navigation by type are defined:

① Lighthouse

- To indicate dangerous shoals, sandbanks, rocks and so forth.
- To obtain a Line of Position (LOP).
- To indicate landfalls, headlands, entrance to estuaries or ports and so forth.

② Light beacon

- To mark a landfall position.
- To be a part of a leading (range) line.
- To mark an obstruction or danger in or near a channel.
- To indicate the lateral limits of a channel or navigable waterway.
- To indicate an area.
- To indicate a turning point or a junction of the waterway.

For the leading light

- To indicate the navigable channel.
- To indicate to deep draught vessels the deepest part of the waterway.
- To indicate the navigable channel where fixed and floating aids to navigation are not available or do not satisfy accurate navigation.
- To provide a safe approach to a harbor or river entrance, particularly where there are crosscurrents.
- To separate two way traffic.

For the sector light

- To indicate the boundaries of a navigable waterway.
- To indicate a change of course position.
- To indicates shoals, banks and so forth.
- To indicate the deepest part of a waterway.
- To indicate position where a buoy is set up. (They areduplicate indications)

For the resilient light beacon

- To indicate the limited boundaries of a navigable waterway.
- To indicate boundaries of a navigable waterway more accurately than buoy and sector lights.

③ Light buoy

- To indicate a lateral limit of a channel or waterway.
- To indicate a navigational danger or hazard.
- To indicate an obstruction which can be dangerous to certain categories of navigation.
- To indicate a landfall position.
- To indicate a mid channel position.

④ Others

The un-lighted beacon and un-light buoy are used as a subsidiary mark for light beacon and light buoy.

The un-lighted beacon and un-light buoy should be located depend on the features of around the site such as kind of ship navigating.

(3) Range of visual aids to navigation

The range of a mark depends on one or more of the following points;

- Metrological visibility
- Contrast and background
- Radar reflecting properties
- Properties of any retro-reflecting device in use
- Light intensity
- Height above sea level
- Observer's height of eye.

The Luminous Range is the maximum distance at which a given signal light can be seen by the eye of the observer at a given time, as determined by the intensity of the meteorological visibility prevailing at that time. It takes no account of elevation, observer's height of eye or the curvature of the earth.

Nominal Range is the luminous range when the meteorological visibility is ten (10) nautical miles, equivalent to a transmission factor of T=0.74.

Generally the nominal range is used on charts and list of lights. However, some countries use luminous range in their publications. And most commonly adopted meteorological visibility is 20 nautical miles, equivalent to a transmission factor of T=0.85.

The Authorities of Indonesia for aids to navigation services that is Directorate General of Sea Communication (DGSC) uses luminous range in his List of Lights (DSI: Daftar Suar Indonesia). Therefore, this plan also use the T=0.85.

(4) Influence and prevention of glare

In the case of shore lights, glare can only be prevented by adequate screening. For aids to navigation lights, it is generally accepted that the luminance at the eye of the navigator produced by a light must not exceed 0.1lux. If the background is very dark this figure must be reduced to 0.01lux according to the IALA Recommendation for Leading Lights of May 1977.

To cope with glare, it should be to raise the focal plane of the light to maintain service range required around the site. To raise the visibility, the synchronized lights can be applied to cope with glare.

(5) Height of the light tower

The height of light tower for fixed aids is specified in this plan as follows;

- Lighthouse — 40m high above ground level
- Light beacon — 30m, 20m and 10m high above ground level depending on the service range required at the around site.

However, in case of offshore light, the height is applied from the above platform level.

(6) Luminous range required for the visual aids to navigation

The service range of the visual aids to navigation is required in this plan for each type of visual aids to navigation as follows;

- Lighthouse 40m — minimum 20 nautical miles
- Light beacon 30m — minimum 18 nautical miles
- Light beacon 20m — minimum 15 nautical miles
- Light beacon 10m — minimum 10 nautical miles

(7) Compositions of equipment and facilities

The composition of equipment and facilities as standards for each lighted visual aids to navigation is as follows:

① Lighthouse

- Area — 5000 m^2 with fencing
- Housing — Living quarters for five (5) Families
Powerhouse
- Equipment
  - Light tower — 40m above ground level
  - Lantern house
  - Lighting equipment
    - Main light — Rotating type lantern with Controller
    - Emergency light — Flashing type lantern with Controller
  - Power supply system:
    - for the lighting equipment — Solar system
    - for the living quarters — Engine generator

② Light beacon

- Area — 400 m^2 with fencing
- Equipment

Light tower	30m, 20m, or 10m above ground level depending on site
Lighting equipment	Flashing type lantern with controller
Power supply system:	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 supply system	Solar system
• Mooring system	32mm diameters for 2.5m float 38mm diameters for 3.5m float
• Associated equipment	Topmark, daymark and Radar reflectors for lateral mark

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 1.1.1**.

The Light Emitting Diode (LED) is applied for the light source of light beacon 10m and light buoy because of its free maintenance and long lifetime.

Table 1.1.1. 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

(8) Construction materials for the light tower

The materials for the light tower is listed up as follow.

- Galvanized steel
- Reinforced concrete
- Cast iron
- Aluminum alloy
- Glass fiber reinforced plastic (GRP)

Each materials have advantage and disadvantage respectively, depending on site condition and construction period and cost.

(9) Improvement of visual aids to navigation

① Day marks

The day marks such as unlighted buoy and unlighted beacon should be improved to the lighted visual aids to navigation in accordance with the changes of traffic volume or kinds of ship on the site.

② Improvement of service range

The improvement of services range of visual aids to navigation is planned considering the following points:

- To raise a focal plane height
- To increase intensity

③ Improvement of structure

On structure of light beacons, wooden and steel pole is changed to Galvanized one in the case of necessity

④ Light monitoring system (Remote control system)

The light monitoring system is planned to monitor and manage the visual aids to navigation at the remote area.

In connection with the monitoring system for lights, the maintainability and cost performance including the initial and running costs should be considered.

In the on-going project by German loan, the ORBCOMM system for a data communication, which has a network of Low-Earth Orbit (LEO) and Gateway Earth Stations, has introduced as a pilot project.

The communication station and three visual aids to navigation to be equipped with monitoring system are developed at DISNAV Tg. Pinang.

In this master plan for development of visual aids to navigation, promotion of monitoring system, careful considerations should be given to watching pilot project as following reason.

- Possibility of theft.
- Necessity of sufficient operation system for recovering.

1.1.2. Rehabilitation and Improvement of Visual Aids to Navigation

As described in **Main Report Volume 1 Chapter 9. 9.1**, 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.

It is due to the fact that there are some DISNAV/Sub DISNAV that could not satisfy availability (95% as minimum requirement) recommended by the IALA for visual aids to navigation system.

The existing visual aids to navigation are operated and maintained under the limited running cost for a procurement of spares, regular maintenance and emergency operation.

In order to keep normal status which has been published on the "List of Light" and "Charts" by GOI and to secure safety navigation for users who depend on normal status, it is decided that they are rehabilitated and improved as early as possible with the development plan.

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 are shown in **Table 1.1.2.** based on the current situation.

Table 1.1.2. Total Number of Visual Aids to Navigation for Rehabilitation and Improvement

			Total	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5
Rehabilitaion 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

The lighthouses to be rehabilitated are shown in **Appendix 1.1.1** and the locations of their lights are shown in **Figure 1.1.10.**

On **Appendix 1.1.1**, each Lighthouse is shown the current status. Current status consists of 4 parts, Operation status, Lantern condition, Power supply condition and Structure condition given by “1” or “0”. In connection with “Operation Status”, the “1” shows good operation status and the “0” shows out of services. Especially, 0(co) in Structure condition shows collapse.

The rehabilitation and improvement of lighthouses are classified 3 parts on the basis of the current status.

They are necessities of 1) Supplying lantern and power supply

2) Repairing structure

3) Replacement of the system

The number of contents for rehabilitation of lighthouses is shown in the following **Table 1.1.3..**

As regards lantern and power supply, the “0” in column shows that lantern and power supply is changed. They are summed up 25 sets in rehabilitation and improvement of lighthouses.

As regards structure, the “0(co)” in column of structure condition and the “0 (co)” in both columns of operation status and structure condition shows a replacement.

And described “0” in column of structure shows a repairing structure.

Replacements of the system are summed up to 5 lighthouses and repairing structures are summed in the contents of 24 lighthouses.

Improvement from light beacon to lighthouse is planned for DSI 1980 and 6190.

Table 1.1.3. 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 light beacons to be rehabilitated and improved are shown in **Appendix 1.1.2** and the locations of their lights are shown in **Figure 1.1.11.** and **Figure 1.1.12**.

On **Appendix 1.1.2,** each light beacons for rehabilitation and improvement are shown current status with 4 parts, Operation status, Lantern condition, Power supply condition and Structure condition given by “1” or “0”. In connection with “Operation Status”, the “1” shows good operation status and the “0” shows out of services. Especially, 0(co) in Structure condition shows collapse.

The rehabilitation and improvement of light beacons are classified 3 parts on the basis of the current status.
They are necessities of 1) Lantern and power supply,
2) Repairing structure,
3) Replacement of the system.
The number of rehabilitation and improvement of light beacons is shown in following **Table 1.1.4.**

As regards lantern or power supply condition, the “0” in column shows that lanterns and power supply are changed simultaneously. They are summed up to 181 sets for rehabilitation and improvement of light beacons.

As regards structure, the“0(collapsed)” shows that the light beacon is a replacement and the“0” in column shows repairing structure.
Replacements of the system are summed up to 71 light beacons and repairing structures are summed up to 109 light beacons.

Table 1.1.4. 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”, being shown in **Appendix 1.1.3.**

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 beacons by phase 1.

(4) Implementation Schedule

In the implementation schedule for the rehabilitation and improvement of visual aids to navigation, first priority is given to the waters around sea lanes, Malacca and Singapore Strait and related waters.

The implementation schedule for master plan of rehabilitation and improvement of visual aids to navigation is shown in **Table 1.1.5.**.

It is planed that light buoys for rehabilitation and improvement are supplied during Phase 1, lighthouse for rehabilitation and improvement is done during Phase 1 and 2.

Table 1.1.5. 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																				

1.1.3. Development of Visual Aids to Navigation

In Master plan, development plan for each type of visual aids to navigation is decided on their locations and project by phase based on necessity for actual state of maritime traffic and its future demand in this survey.

Estimate of 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 phase by priority. Each phase is considered to be able to put into operation with proper scale for business.

(1) Estimate for 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 years.

After publication of last master plan as of year 1985, the amount of investment for visual aids to navigation in Indonesia had been about US$142,000,000- , described in **Chapter 3** of **Main Report Volume 1**.

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.

On the basis 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 precedes the routes for approaching to Indonesia or 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 1.1.6.** The result of priority for lighthouses and light beacons by score is shown **Appendix 1.1.4** and **Appendix 1.1.5** respectively.

However, each light buoy is not evaluated because it is installed at a specific area by District of navigation office.

(4) Development plan of lighted visual aids to navigation

The lighthouses and light beacons to be developed up to year of 2020 are shown in **Appendix 1.1.6** and **Appendix 1.1.7** respectively.

The light buoys to be developed up to 2020 are allocated to District of Navigation office shown in **Table 1.1.7.**

The locations of lighthouses and light beacons to be developed up to year of 2020 are shown in **Figure 1.1.13** and **Figure 1.1.14.**

The total numbers of lighted visual aids to navigation by each DISNAV up to year of 2020 are as shown in **Table 1.1.7.**

Table 1.1.6. Evaluation Criteria for Lighthouse and Light beacons

Evaluation						
		Item	Score	Weigtht	Distribution	Remarks
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, Malaysia -Singapore strait 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 por		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	
		Total score			75	

Table 1.1.7. Visual Aids to Navigation to be Developed up to 2020 by each DISNAV

No.	ATN Office	Lighthouse					Light Beacon					Light Buoy				
		Exist ing	Ongo ing	Deveroping	Total	Increse Ratio	Exist ing	Ongo ing	Deveroping	Total	Increase Ratio	Exist ing	Ongo ing	Deveroping	Total	Increase Ratio
1	SABANG	9	0	2	11	22.2%	31	0	12	43	38.7%	4	0	2	6	47.3%
2	BELAWAN	5	0	1	6	20.0%	45	0	3	48	6.7%	27	10	13	50	84.3%
3	SIBOLGA	7	0	0	7	0.0%	46	0	17	63	37.0%	0	0	0	0	
4	DUMAI	5	0	0	5	0.0%	34	0	8	42	23.5%	54	18	26	98	80.6%
5	TG. PINANG	22	1	7	30	36.4%	71	3	20	94	32.4%	26	12	12	50	93.4%
6	TLK. BAYUR	8	0	2	10	25.0%	40	0	6	46	15.0%	0	0	0	0	
7	PALEMBANG	4	0	5	9	125.0%	63	0	10	73		16	6	8	30	84.8%
8	TG.PRIOK	27	0	7	34	25.9%	96	2	11	109	13.5%	45	27	21	93	107.3%
9	SEMARANG	7	0	1	8	14.3%	31	0	8	39	25.8%	12	4	6	22	80.6%
10	CILACAP	6	0	0	6	0.0%	17	0	3	20	17.6%	5	0	2	7	47.3%
11	SURABAYA	19	0	2	21	10.5%	58	0	7	65	12.1%	36	12	17	65	80.6%
12	BENOA	15	0	5	20	33.3%	57	3	3	63	10.5%	8	2	4	14	72.3%
13	PONTIANAK	3	1	1	5	66.7%	42	1	5	48	14.3%	14	4	7	25	75.9%
14	BANJARMASIN	7	0	2	9	28.6%	38	0	14	52	36.8%	18	7	9	34	86.2%
15	SAMARINDA	5	0	4	9	80.0%	48	0	4	52	8.3%	17	6	8	31	82.6%
16	TARAKAN	2	0	1	3	50.0%	24	0	4	28	16.7%	6	0	3	9	47.3%
17	MANADO/BITUNG	21	0	8	29	38.1%	84	2	35	121	44.0%	7	0	3	10	47.3%
18	KENDARI	6	0	3	9	50.0%	62	0	46	108	74.2%	0	0	0	0	
19	UJ.PANDANG	18	0	2	20	11.1%	50	0	27	77	54.0%	8	5	4	17	109.8%
20	KUPANG	13	4	7	24	84.6%	48	8	22	78	62.5%	3	0	1	4	47.3%
21	AMBON	12	5	18	35	191.7%	71	4	7	82	15.5%	5	0	2	7	47.3%
22	JAYAPURA	7	0	3	10	42.9%	34	0	26	60	76.5%	0	0	0	0	
23	SORONG	6	0	10	16	166.7%	52	0	20	72	38.5%	17	6	8	31	82.6%
24	MERAUKE	1	0	0	1	0.0%	26	0	4	30	15.4%	4	0	2	6	47.3%
25	B T K P												Sub Total	157		
													Spare	193		
	TOTAL	235	11	91	337	46.8%	1,168	23	322	1,513	30.0%	332	119	350	608	60.5%

1.1.4. Total Number of Visual Aids to Navigation for Master Plan

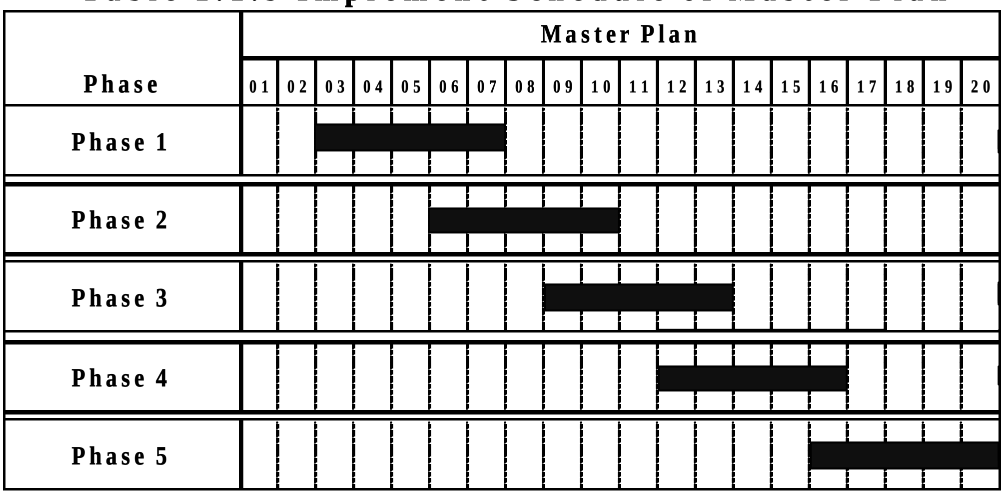
Total number of visual aids to navigation including at rehabilitation, improvement and development up to year of 2020 is shown by each type of visual aids to navigation in **Table 1.1.8** (They did not include those by German loan.). Implementation schedule of the Master Plan up to year of 2020 is divided into 5 phases. It is shown in **Table 1.1.9.**.

Table 1.1.8 Total Number of Visual Aids to Navigation

			Total	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5
Devleopment	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 1.1.9 Implement Schedule of Master Plan



1.1.5. Cost Estimate of Visual Aids to Navigation

The cost required for master plan of visual aids to navigation is shown in **Table 1.1.10.**

It includes the cost of rehabilitation for visual aids to navigation.

Light due which is imposed as beneficiary fee has been collected since 2001 year. There is a possibility to assign a part of light due for rehabilitation of existing visual aids to navigation.

Table 1.1.10. 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

Figure 1.1.1. Designated Traffic Routes of Tanker

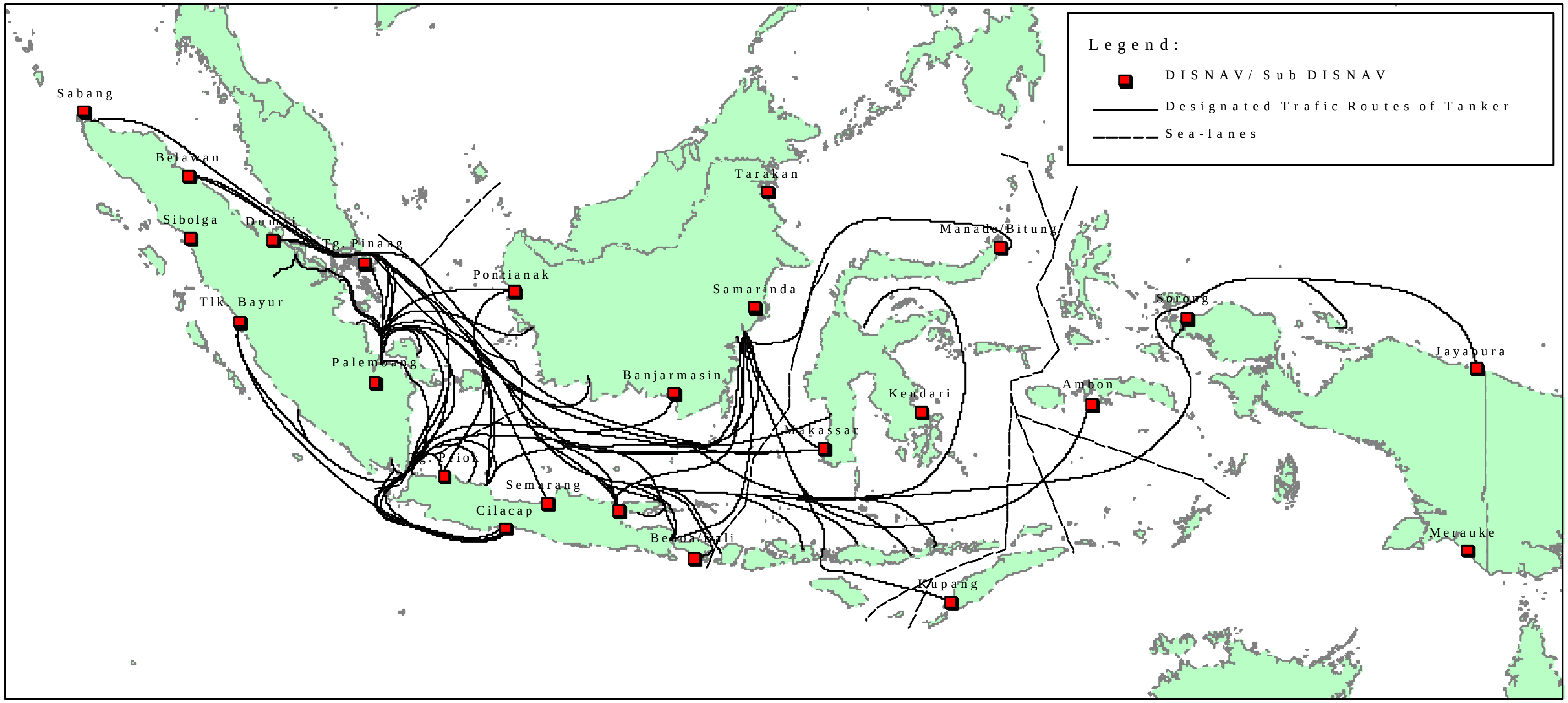


Figure 1.1.2. Designated Traffic Routes of Passenger Ships

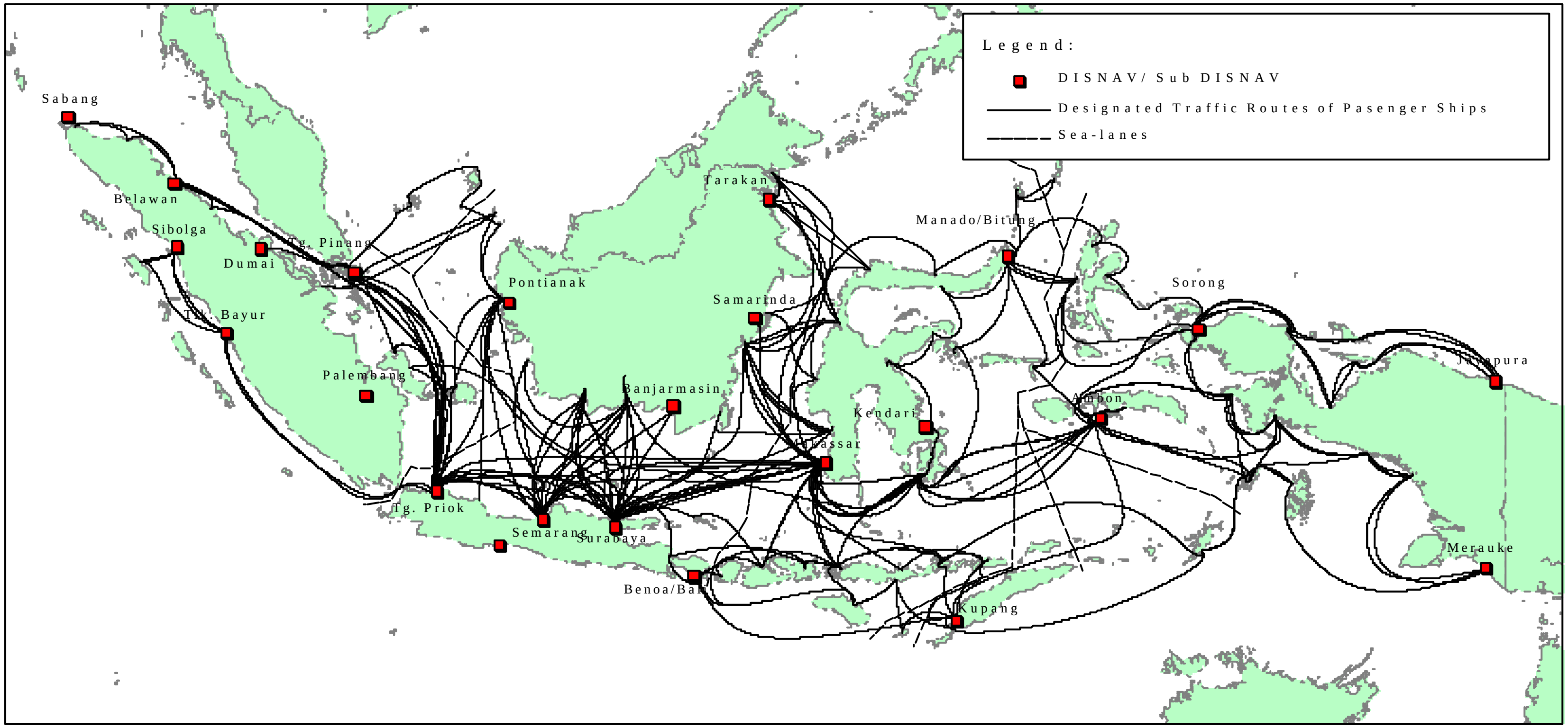


Figure 1.1.3. Designated Traffic Routes of Pioneer Service Ships

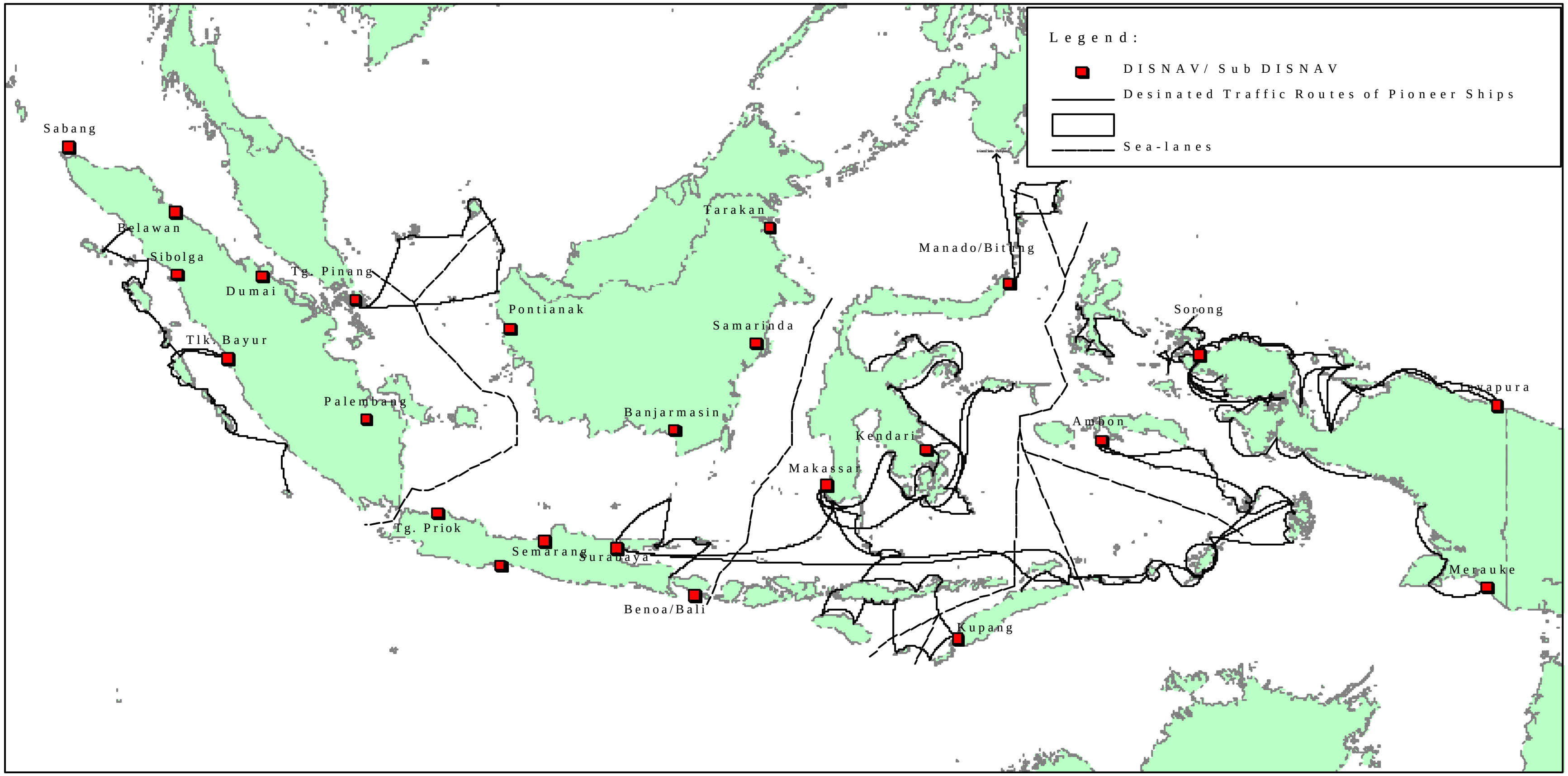


Figure 1.1.4. Traffic Routes of General Cargos

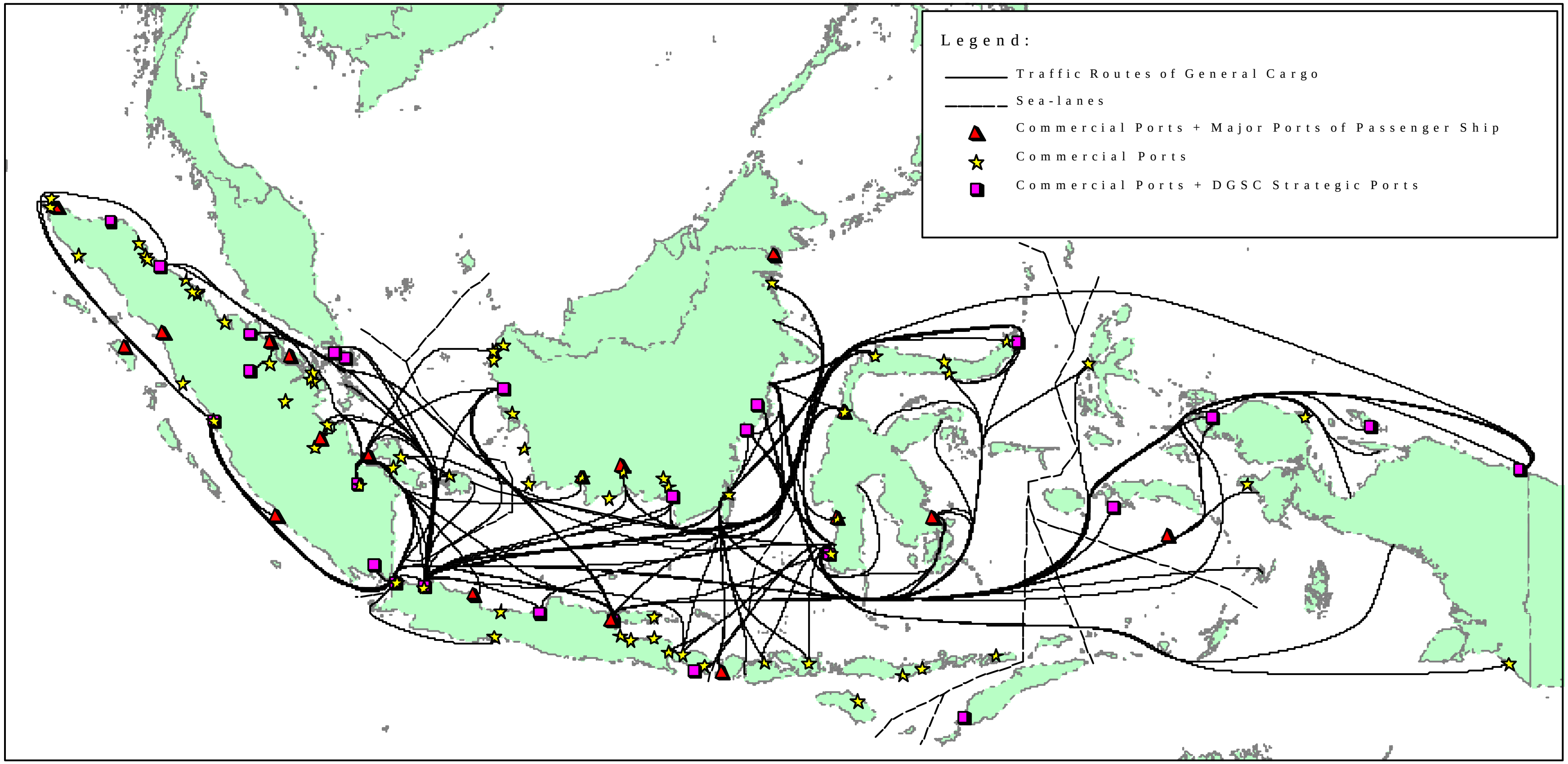


Figure 1.1.5. Designated Traffic Routes of Container Ships

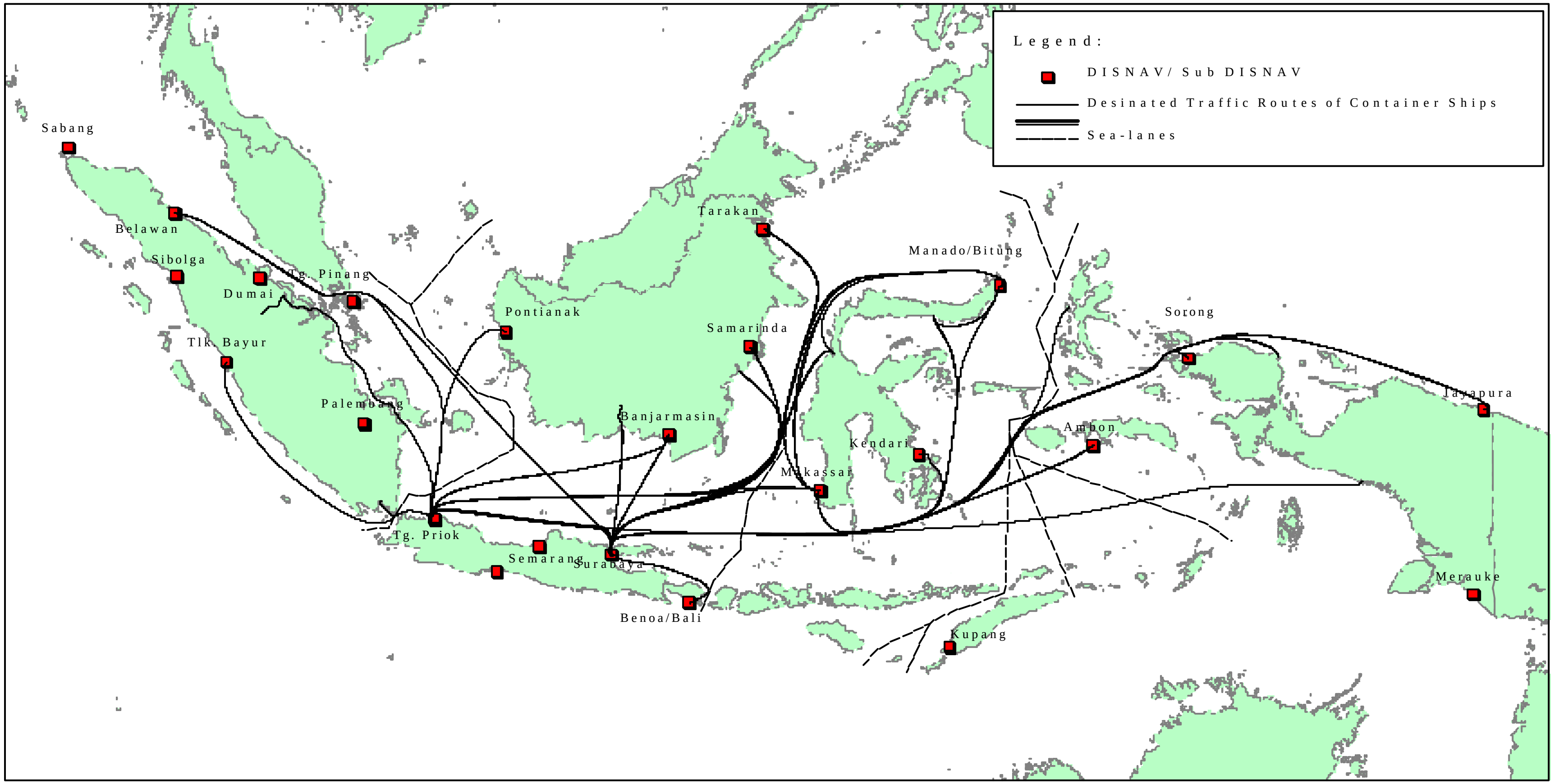


Figure 1.1.6. Location of Marine Casualties by Causes (Year 1992 to 2000)

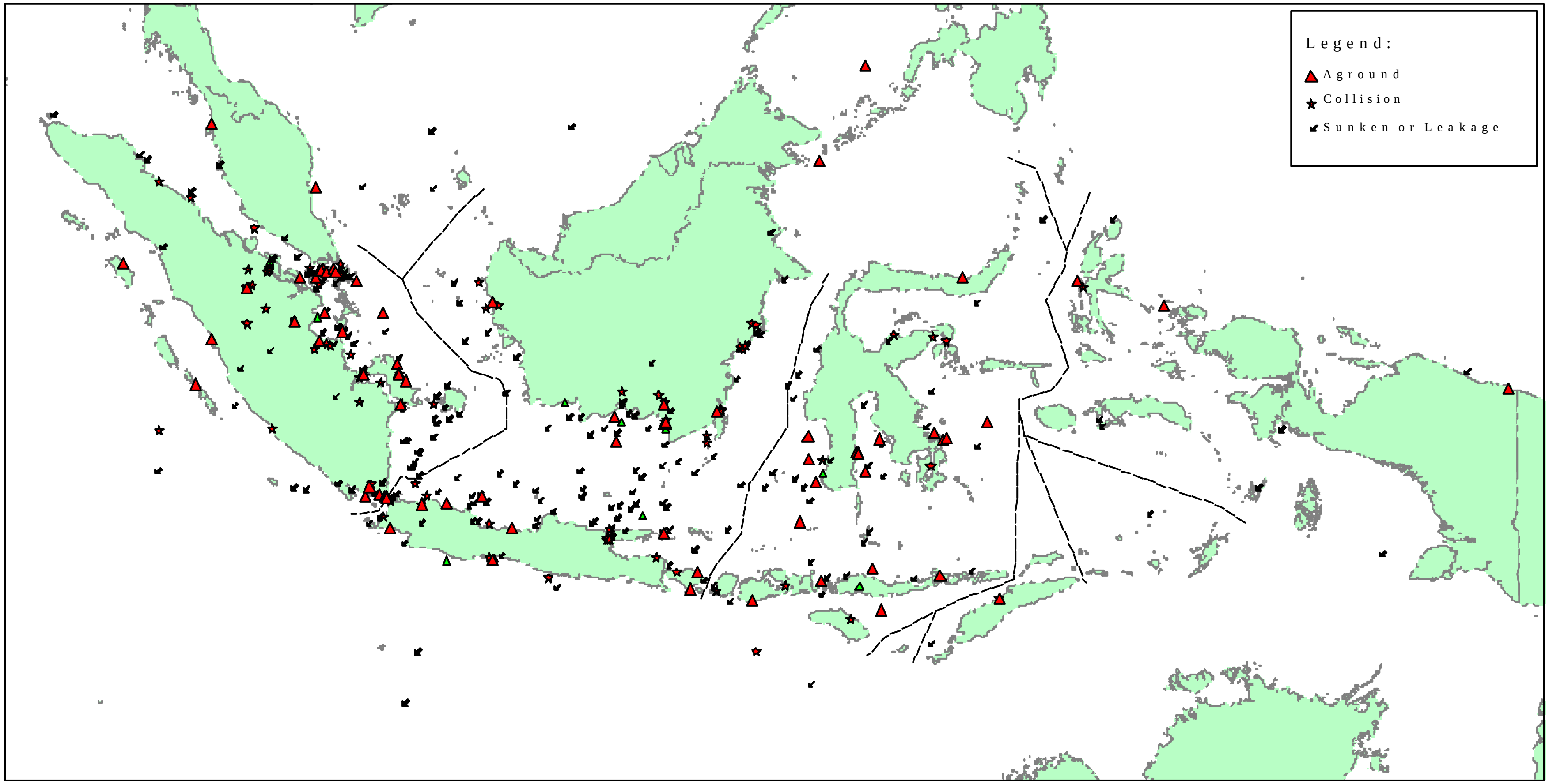


Figure 1.1.7. Location Map of Commercial Ports and Non-Commercial Ports

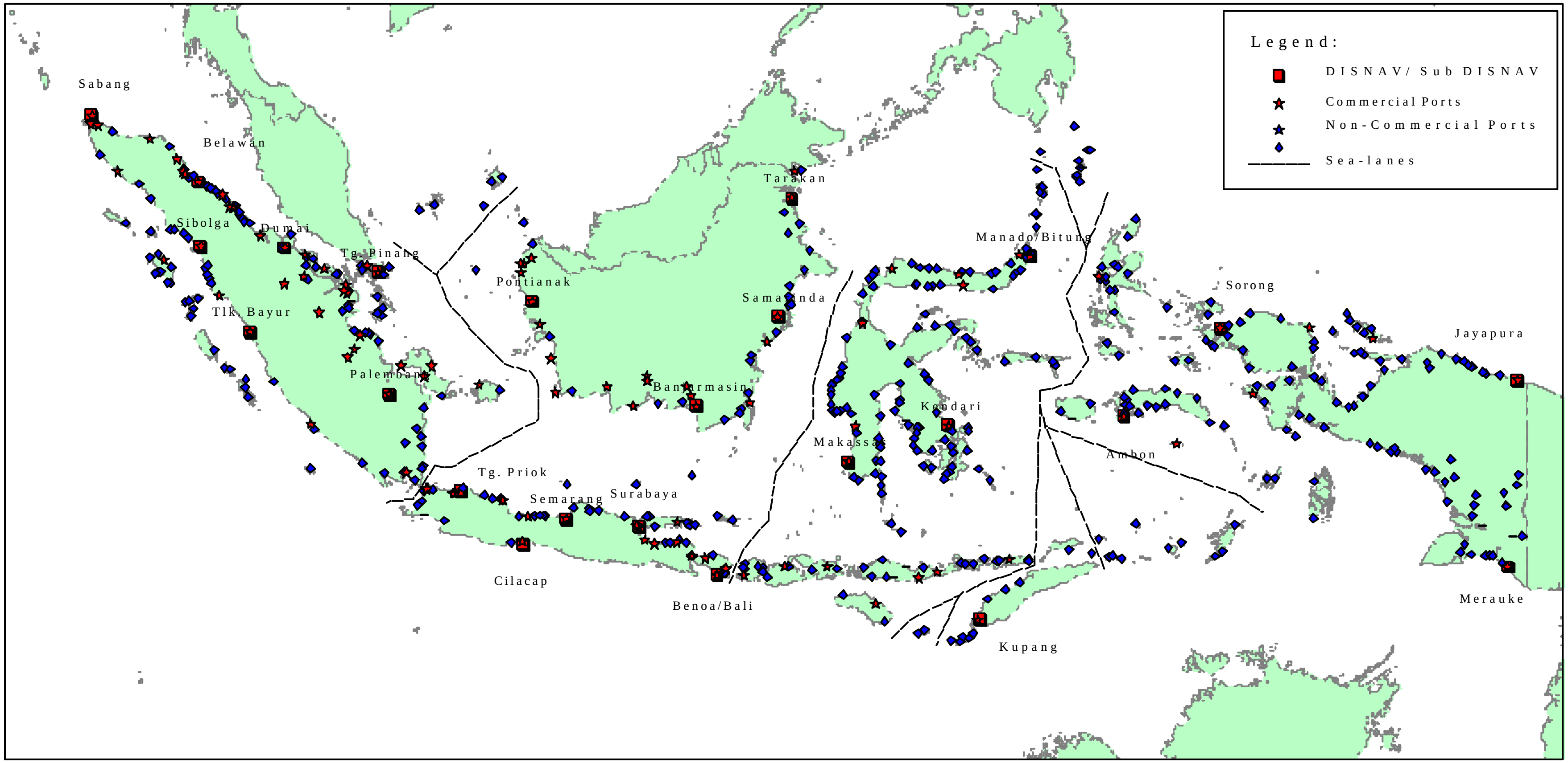


Figure 1.1.8. Location Map of Main Ports under SISTRANAS

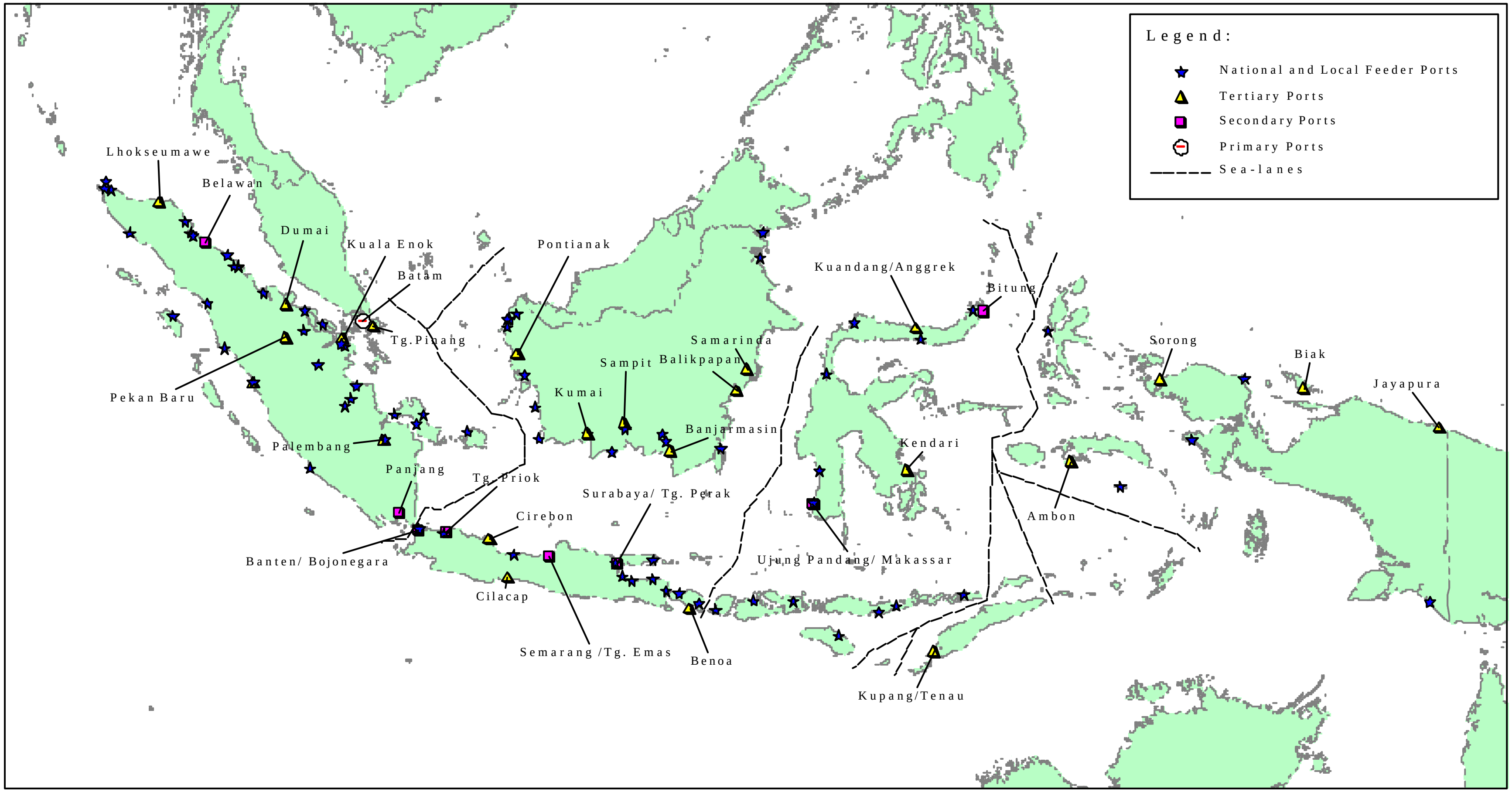


Figure 1.1.9. Location Map of DGSC Strategic Ports

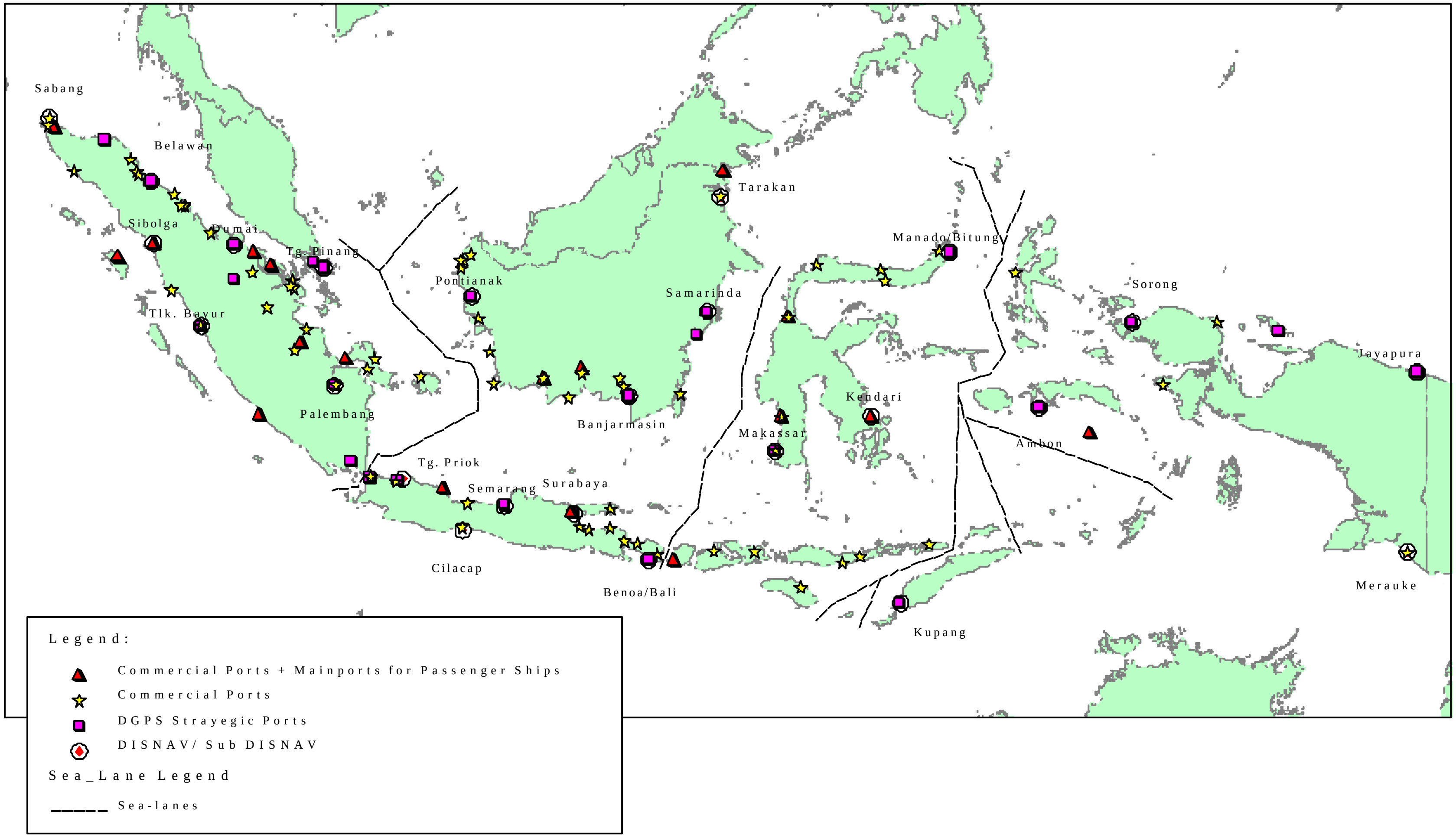


Figure 1.1.10. Designated Location of Rehabilitation and Improvement of Lighthouses in Master Plan up to 2020

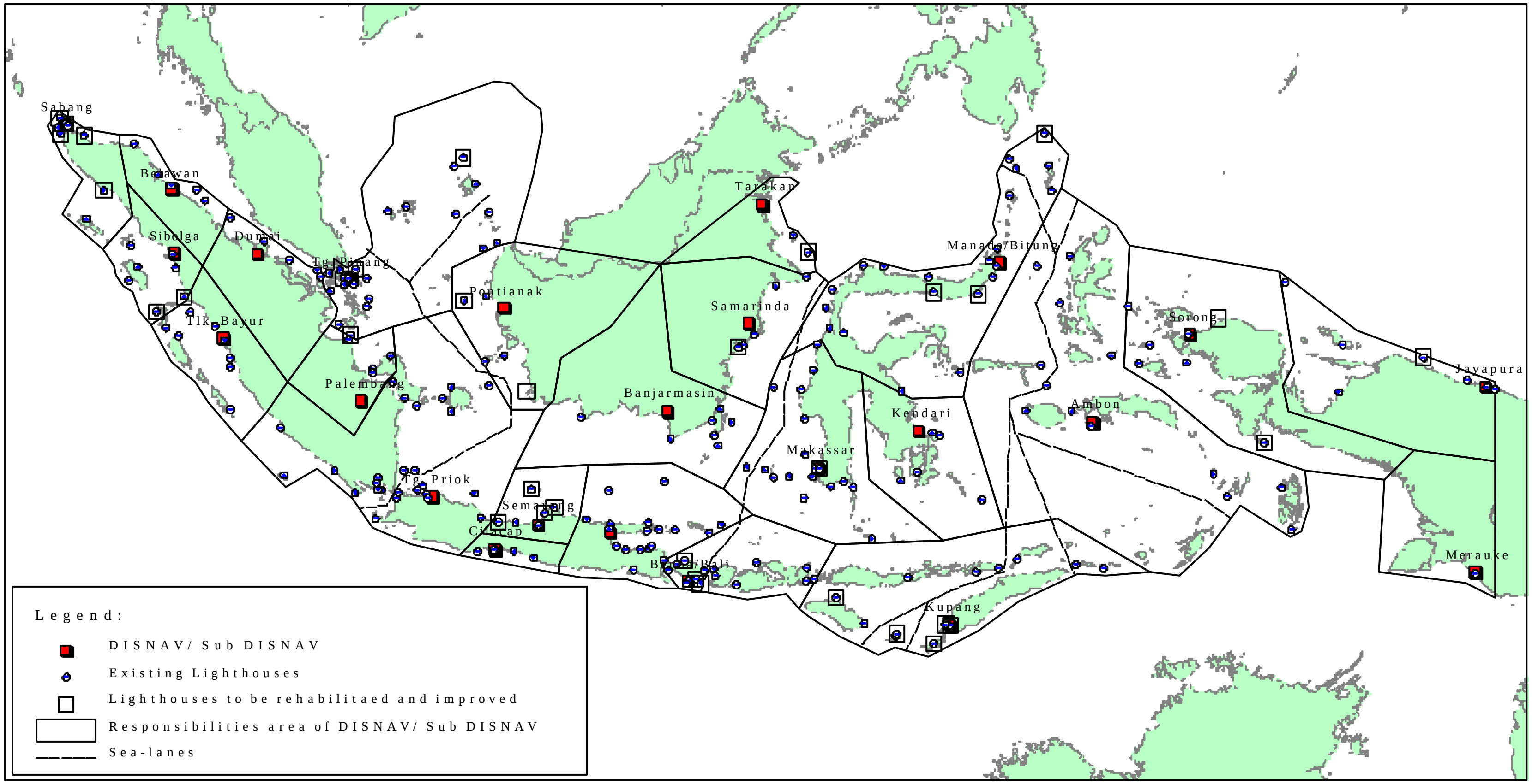


Figure 1.1.11. Location Map of Rehabilitation and Improvement of Light Beacons in Master Plan up to 2020 (1/2) Eastern Indonesia

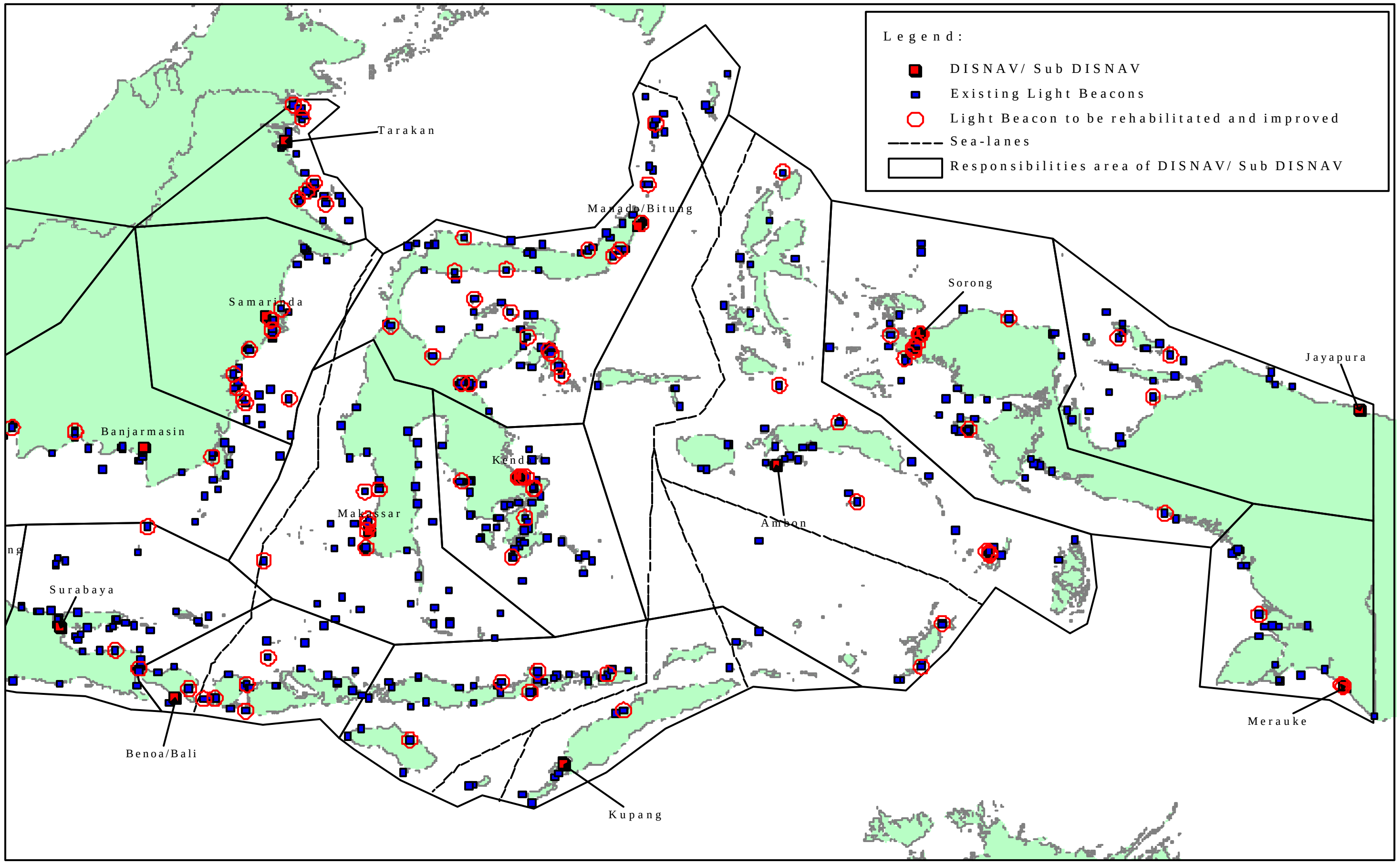


Figure 1.1.12. Location Map of Rehabilitation and Improvement of Light Beacons in Master Plan up to 2020 (2/2) Western Indonesia

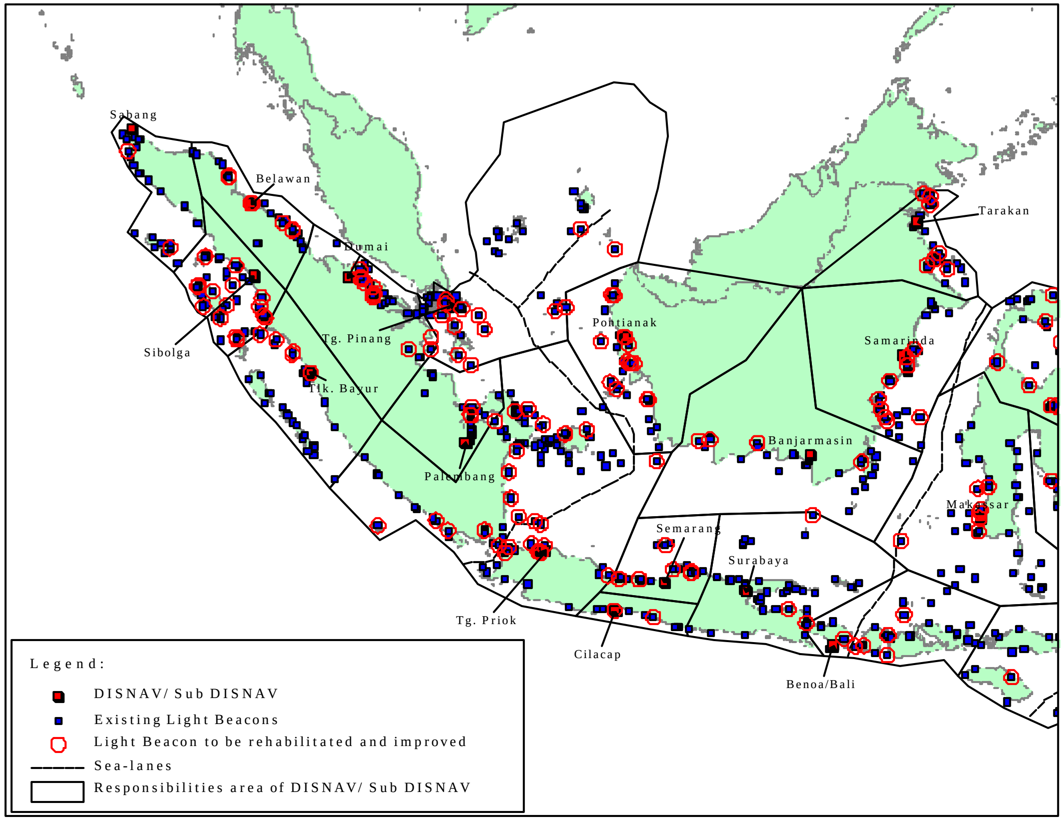


Figure 1.1.13. Location Map of Development of Lighthouse in Master Plan up to 2020

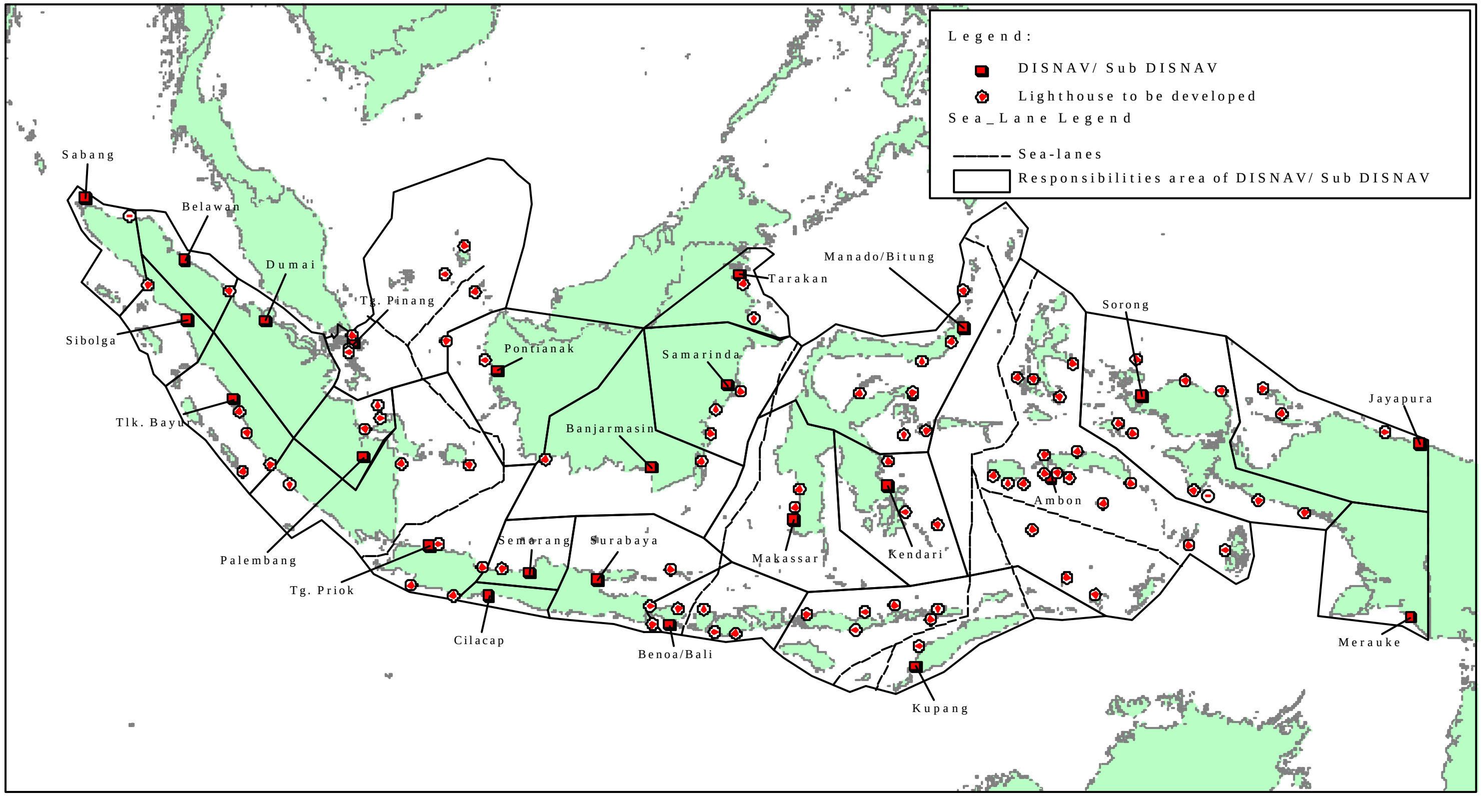
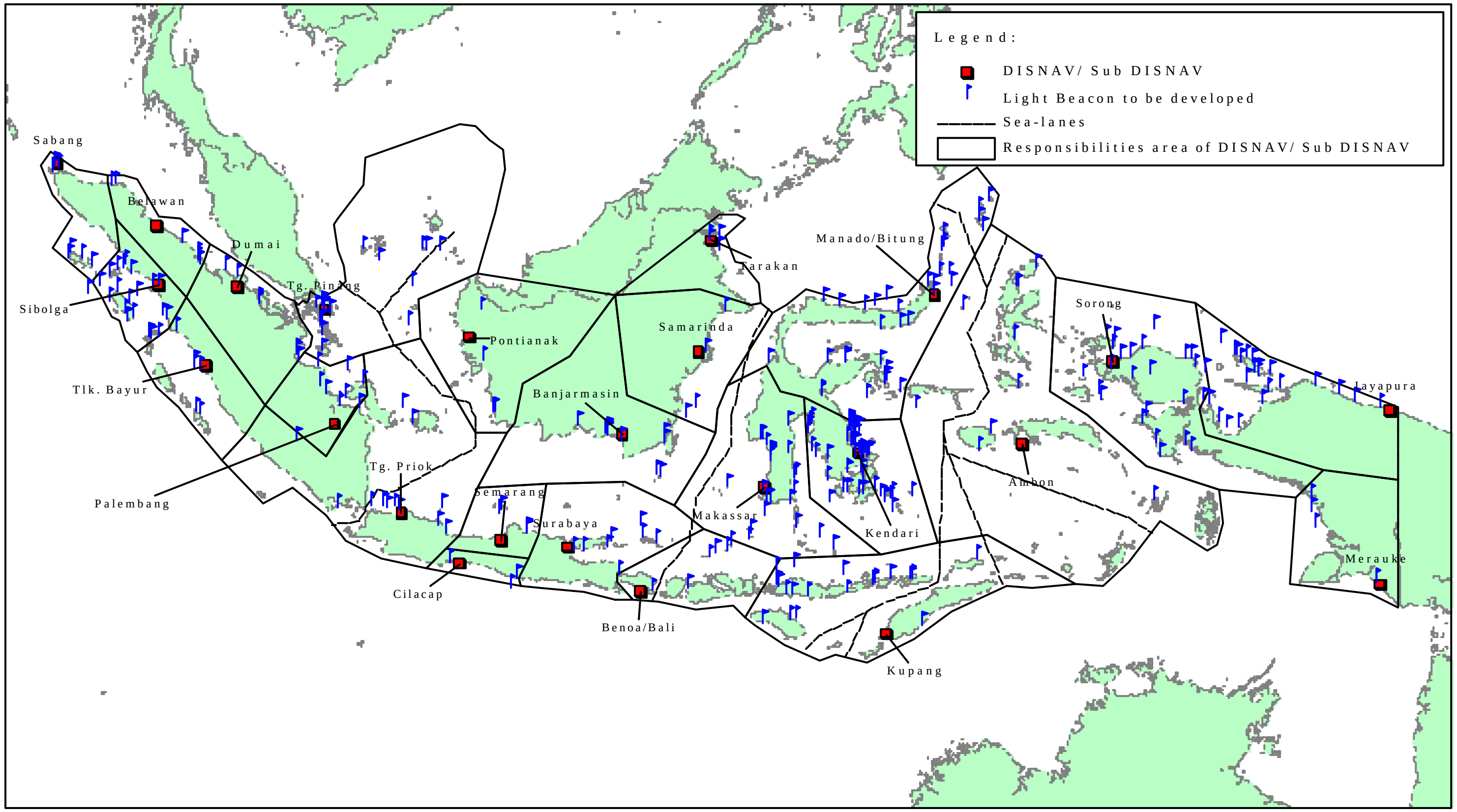


Figure 1.1.14. Location Map of Development of Light Beacons in Master Plan up to 2020



1.2. Radio Aids to Navigation

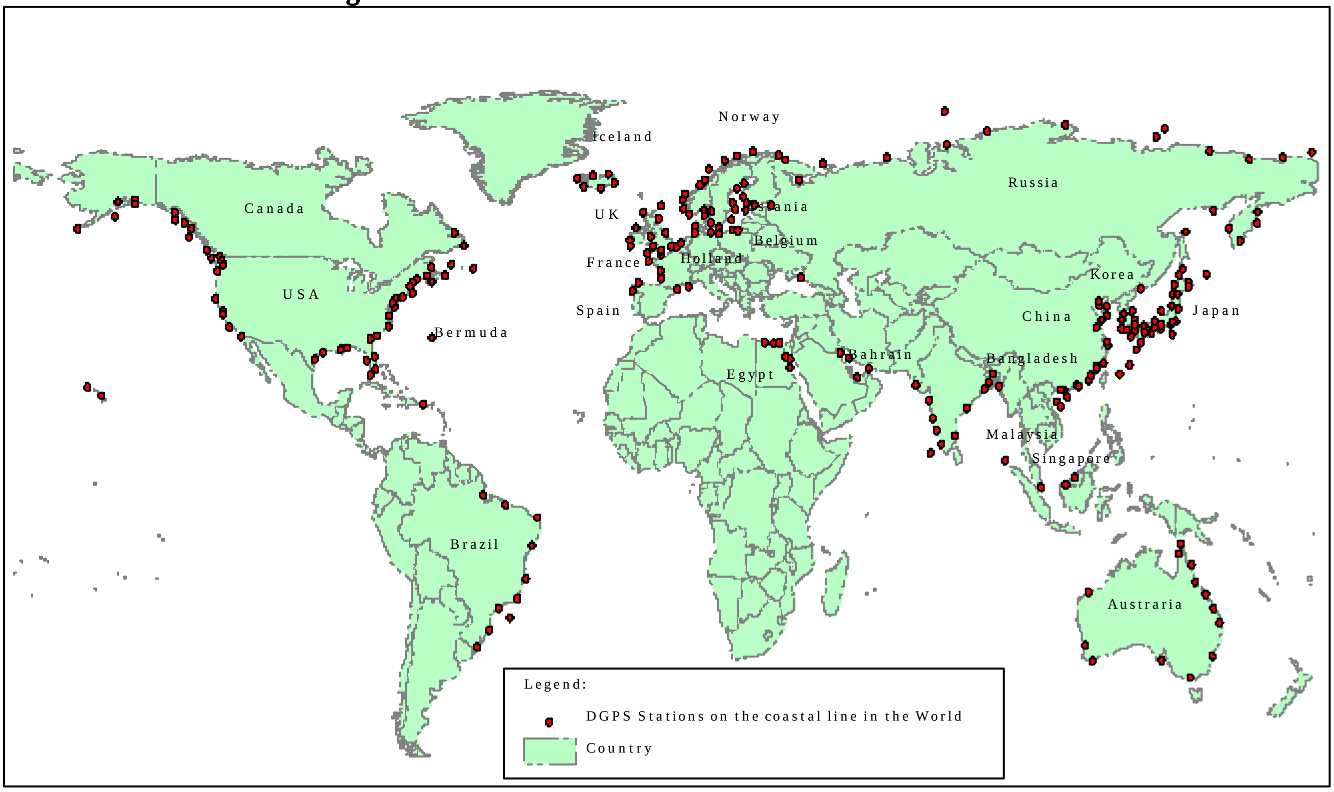
1.2.1. Necessity of DGPS

(1) DGPS in the world

Many of the Medium Wave Radio Beacon (MFB) stations in the world were changed to DGPS stations, and the exclusive MFB stations out of subject for the DGPS have been closing and terminated their roles as the navigation positioning system.

The DGPS stations on the coastal line in the world are shown in **Figure 1.2.1.**

Figure 1.2.1. DGPS Stations in the World



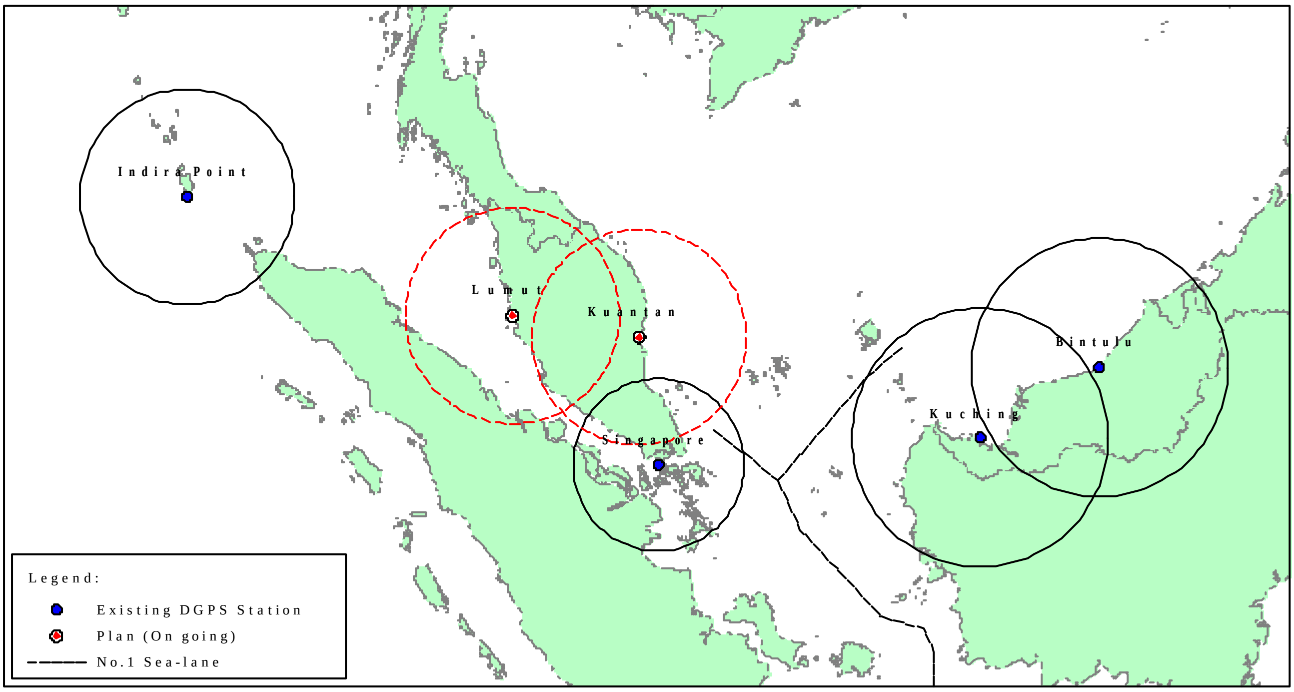
Four (4) DGPS stations are operated, which are Bintulu and Kuching DGPS stations operated by Malaysia on the northern coastal line of Kalimantan, Indra Point DGPS station operated by India at the northern entrance of Malacca Strait and Singapore DGPS station at the southern entrance of Malacca Strait.

Furthermore, Malaysia have a plan to additionally open two (2) DGPS stations that are Lumut located at the middle of Malacca Strait and Kuantan located at the eastern coast line of the Peninsula of Malaysia in year of 2002.

As a result, main part of Malacca and Singapore Strait except around Dumai port is covered by DGPS stations, which are Singapore DGPS station and two (2) DGPS stations planned by Malaysia. A part of northern waters of Sea Lane I is covered by Kuching DGPS station.

Coverage area of DGPS stations operated and planned by neighboring countries is shown in **Figure 1.2.2.**

Figure 1.2.2. Locations of DGPS Stations of Neighboring Countries



(2) Necessity of DGPS

In connection with the international trend on the DGPS, at the IALA conference on June 2001, Draft Policy on "The Further of the Marine LF/MF Differential Global Navigation Satellite System (DGNSS)" prepared by Radionavigation Committee 15th Session as RNAV 15/5/3r2 on March 8, 2001 was approved.

In this paper, it is stated that GPS accuracy was improved from 100m with SA to approximately 15-25m without SA. However, IALA has already reaffirmed as a matter of policy the need to continue to maintain and develop DGPS services because of the current IMO requirements for 10m position accuracy (95%) and 1 second integrity warning of satellite malfunction for navigation in harbor entrances / approaches and coastal waters for SOLAS vessels. The continuing need for DGPS is further reinforced as it provides vital input for proper operation of Electronic Chart Display Information System (ECDIS), Electronic Chart System (ECS) and Automatic Identification System (AIS).

At present, many countries are developing DGPS stations, because they are the only means which satisfies the “10m positioning accuracy (95%) and 1 second integrity”.

AIS system, which is required more accurate positioning system, and also required to have system integrity, and by which the reliability of positioning system is guaranteed.
DGPS, that is the positioning system guaranteed the reliability, is the only satisfied system for ship’s positioning.

(3) 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.
The result of the Survey indicates that 26.6% of respondents have experience of using DGPS receivers in foreign countries or around Malacca and Singapore Strait.

900 ships (about 74% of total respondents) have GPS receivers and among them there were 153 GPS receivers being able to receive DGPS signal.

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 GPS accuracy measurement confirmed that the static accuracy is ranging from 7.9m to 13.5m among five (5) GPS receivers, or the mean of error of five (5) GPS receivers is 10.5m, standards distribution is 2.1m and valiance is 4.4m as of June 2001.

(4) Waters requiring DGPS in Indonesia
The waters, where DGPS stations should be established in Indonesia, are the followings:
① Waters in and around ports and harbors, where entry and departure of ships

are difficult

- Where high-level operation skill is required because there are dangers such as shoals, atoll and so forth around navigation route, or navigation route bended.
- Where many large and small vessels enter at the same waters, or many foreign vessels, which are unfamiliar with the waters in the vicinity.

② Narrow channels, and the waters where there are danger ours reefs or a group of islands

- Where navigable width is narrow, and many large and small vessels navigate simultaneously.
- Where foreign flag vessels and so forth, which are unfamiliar with the waters, navigate international traffic route.
- Where tide is fast and steady maneuver is difficult.

1.2.2. 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

(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.

It is assumed that about forty-two (42) % of sinking casualties might be caused by collision and stranding, it is expected to decrease sinking accidents by using DGPS.

(2) Improvement of efficiency of vessel operation (decrease of navigation cost)

With the improvement of positioning accuracy, the positioning of vessels can secured and efficiency of vessel operation will be improved and navigation cost will be decreased.

As a result, it is estimated that navigation cost of about five hundred thirty (530) million Japanese Yen will be saved at only four major ports, that is, Tg. Priok, Surabaya, Makassar and Balikpapan in Indonesia. There is a great contribution to economic development by the activation of maritime sector.

(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)%.

In major advanced nations, the coastal waters are mostly covered by DGPS as shown in **Figure 1.2.1.**

On the other hand, it is a policy of Indonesia to promote national activation by reinforcement of maritime sector.

For Indonesia as a maritime country, it is indispensable to make major harbor entrance and approaches safe and efficient for navigating vessels according to the recommendation of IMO.

(4) Meeting new international standards and development of infrastructure

The IMO has completely revised the Chapter V of SOLAS Convention that specifies the appropriate measures and so forth on the installation standards of navigation facilities and the navigation safety.

Revision of the convention include the followings:

- Settlement of functional requirements in the installation standards of navigation facilities,
- Review of the installation standards for onboard facilities, and
- Addition of new navigation facilities, and so on.

The revision includes GPS receiver, Automatic Identification System (AIS), Electric Chart Display and Information System (ECDIS) and Vessel Traffic Services (VTS), in relation to the aids to navigation system. It will become effective on July 1st, 2002.

① GPS receiver with DGPS function (For user equipment)

In this revision, all vessels have an obligation to install GPS receiver and so forth.

It is specified on GPS receiver in IMO resolution A.819 (19) as follows:

- GPS receiver must have a capability to process DGPS data in compliance with the standards concerning Radio Technical Commission for Maritime Services (RTCM) and the recommendation standards based on International Telecommunication Union ITU-R M823.
- Performance standards on static and dynamic accuracy of GPS receiver must be an error not greater than ten (10) m with a probability of ninety-five (95)%, if DGPS receiver is housed in GPS receiver.
  It is requested that an accuracy within 10m must be guaranteed, to both side of operation (Authority) and user, according to the IMO resolution A.815 (15) and A.819 (19), respectively.

② AIS

It is the most remarkable point that all vessels must have responsibility to install AIS equipment.

AIS transmits automatically a Identification Code, Course, Speed and so forth that are data of vessel's own, for the following purposes:

- To accurately grasp the mutual movement among vessels, each other.
- To make a safe navigation such as the avoidance of collision.
- To profit for vessel operation in efficiency.

The most important key factor of AIS is "Position", "Course" and "Speed". This information is regularly figured out by processing based on the positioning data by GPS receiver.

It is required that positioning data on both static and dynamic is far superior, in order to operate AIS effectively.

For this reason, it is the responsibility for authorities to operate aids to navigation system to provide high accuracy positioning system by DGPS.

③ VTS and AIS

It is also specified in the revised SOLAS Convention that AIS must have a function of data communication between vessel and aids to navigation facilities like VTS.

The positioning information by AIS must be accurate in order to:

- Grasp accurately a movement of vessel at VTS, and
- Coordinate traffic effectively in the congested waters.

For these purposes, it is indispensable to obtain high accuracy positioning information by DGPS in the waters of VTS.

④ ECDIS and AIS

ECDIS has become available for navigation instead of former nautical charts by the revised SOLAS Convention.

In Malacca and Singapore Straits, Sea Lanes Ⅰ and Ⅱ in Indonesia, it is in progress to digitize nautical charts, and it is expected that ECDIS will spread in the near future.

There is a close relation between AIS and ECDIS. These become an epoch making navigational tool by combining both systems.

For this reason, it is indispensable to develop DGPS system as infrastructure for providing high accuracy positioning data.

(5) 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.

1.2.3. 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.

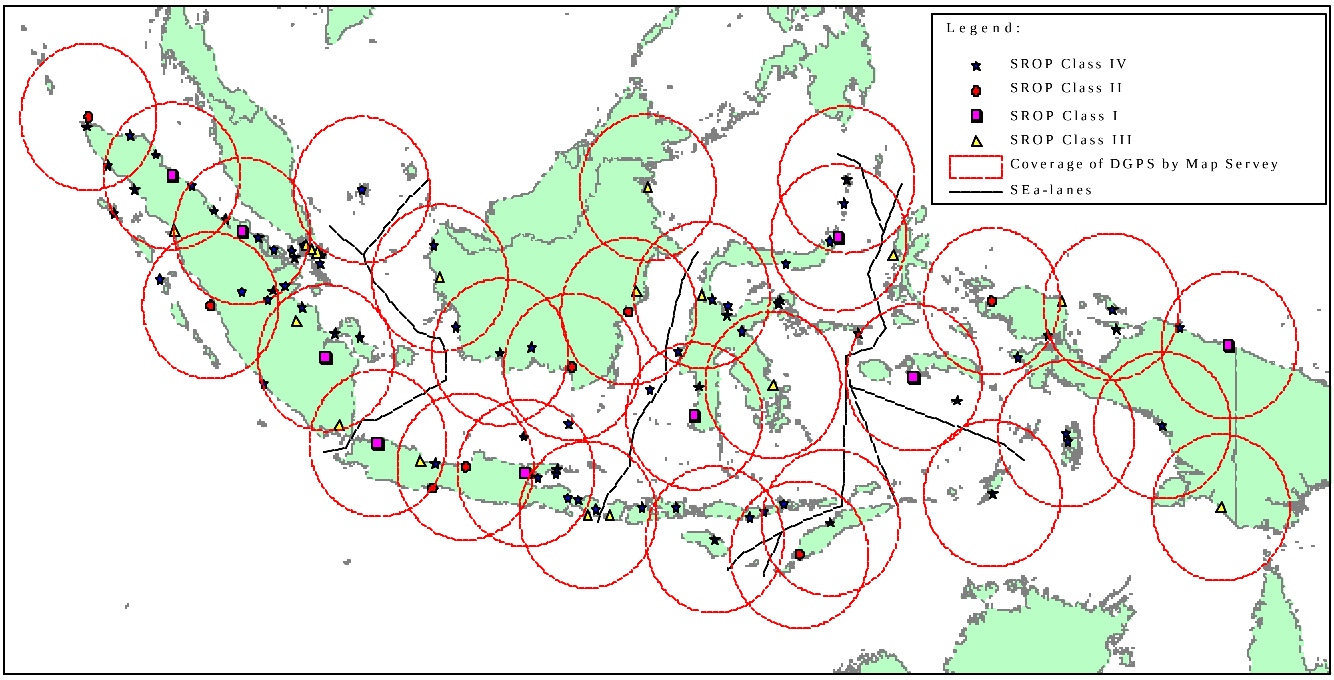
The locations of DGPS stations are selected by the followings:

- 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

As for the first study, the waters to be covered by DGPS Stations were selected through the map survey to cover all Indonesian waters and also in consideration of AIS. These selected waters are covered by DGPS stations to be co-sited at the existing coastal radio station (SROP) as shown in **Figure 1.2.3.**

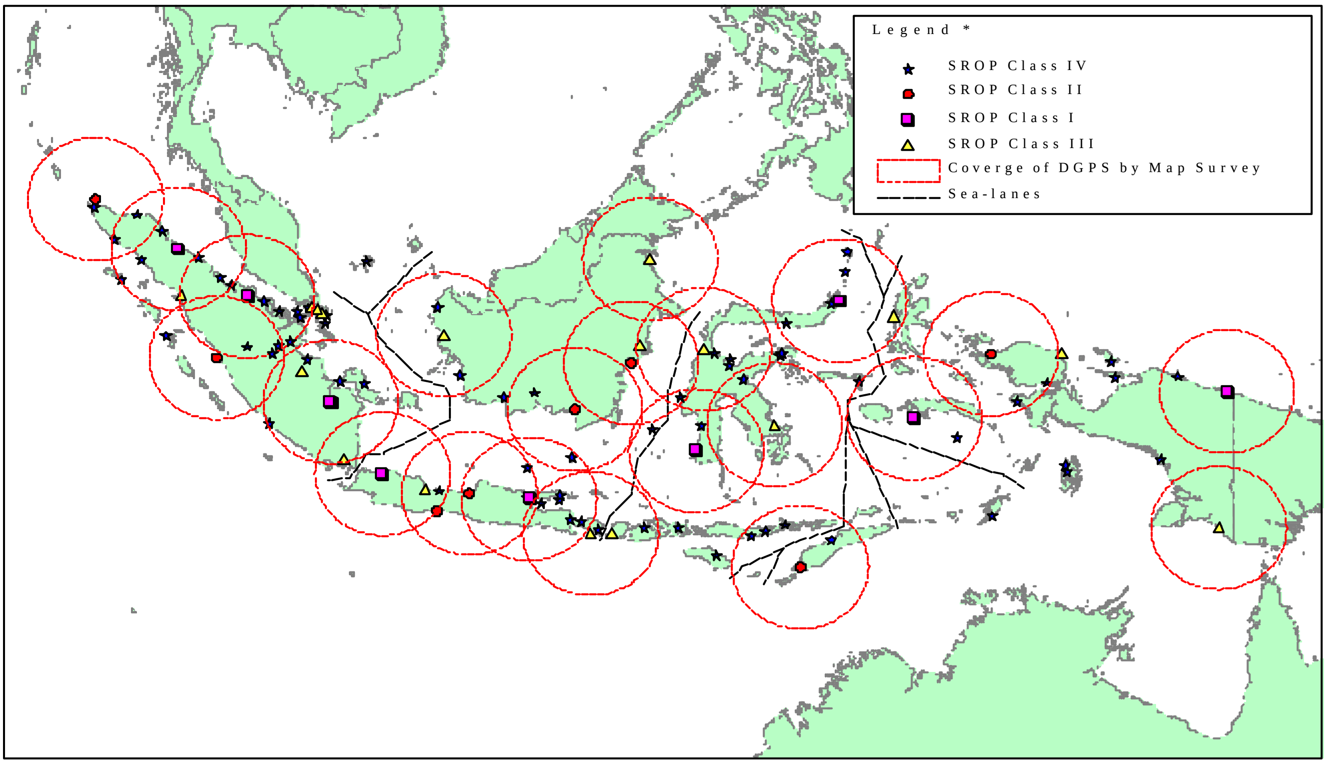
Figure 1.2.3. Map Survey for Selection of Waters to be covered by DGPS (First Study)



The DGPS station must be co-sited at the coastal radio stations, which can obtain commercial power source and technicians and operators with good skill to avoid the lowering operation status.

However, site areas of SROP Class IV is too small to construct antenna system of DGPS. For this reason, SROPs of Class IV, which were not suitable to operate DGPS station for 24 hours, were excepted in the second study as shown in **Figure 1.2.4.**

Figure 1.2.4. Map Survey for Selection of Waters to be covered by DGPS (Second Study after removal of SROP Class IV)



The SROPs of Class IV excepted from the first study are Tarempa, Kumai, Bima, Atapupu, Dobo, Sanana, Biak and Agats.

After the second study, twenty-two (22) locations remained as the nominated DGPS stations to cover the waters in Indonesia. These locations that will co-site at the coastal radio stations are shown in Table **1.2.1.**

Table 1.2.1. Locations of Coastal Radio Stations to be studied for DGPS Station

No.	Name	Class	Latitude	Longuitude	Province
1	Sabang	II	05-54-00N	095-21-00E	D.I. Ache
2	Belawan	I	03-43-17N	098-40-08E	Sumatera Utara
3	Dumai	I	01-41-10N	101-27-20E	Riau
4	Telk Bayur	II	01-02-20S	100-11-50E	Sumatera Barat
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
14	Tarakan	III	03-17-28N	117-35-25E	Kalimantan Timur
15	Makassar	I	05-06-22S	119-26-31E	Sulawesi Selatan
16	Pantoloan	III	00-39-54S	119-44-45E	Sulawesi Tengah
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
21	Jayapura	I	02-31-10S	140-43-22E	Irian Jaya
22	Merauke	III	08-28-47S	140-23-38E	Irian Jaya

(1) Evaluation method of waters to be covered by each DGPS station

These locations were evaluated for the selection of the proposed DGPS stations in the Master Plan in accordance with the evaluation criteria shown in **Table 1.2.2.**

The waters to be covered by DGPS stations were evaluated for the followings:

① Situation of waters that the accuracy of DGPS will be required, that is; harbor entrance and approaches and the waters where maneuver ability is limited
that is;
- Ports and harbors by Government regulation No.70/1996 (Current situation)
- Main ports under SISTRANAS (Future's demand)
- Map survey on waters with dangers, reefs, atolls and narrow channels where traffic is crossing.

② Situation of number and location of marinecausalities with coordinates, that is;
- Grounding and collision
- Sinking and flooding which may be caused after grounding or collision

Table 1.2.2. Evaluation Criteria for Selection of Waters covered by DGPS

No	Evaluation Items	Weight			Distributio	Score
1	Harbor Entrance and Approches	0.3				300
1-	Existing Ports within the coverage area		0.6			180
	① DGSC Strategic Ports (25 ports) or Main Ports for Passenger Ships (48			0.5		90
	- 3 ports or more				1	90
	- 1 - 2 ports				0.5	45
	② Commercial Ports (68 ports)			0.3		54
	- 4 ports or more				1	54
	- 1 - 3 ports				0.5	27
	③ Non-Commercial Ports (544 ports)			0.2		36
	- 34 ports or more				1	36
	- 17 - 33 ports				0.5	18
	- 1 - 16 ports				0.25	9
1-	Ports under SISTRANAS (111 ports) within the coverage area		0.4			120
	① Primary Port (1 port) or Secondary Ports (8 ports)			0.5		60
	- 2 ports or more				1	60
	- 1 port				0.5	30
	② Tertiary Ports (23 ports)			0.3		36
	- 2 ports or more				1	36
	- 1 port				0.5	18
	③ National Feeder Ports (21 ports) or Local Feeder Ports (58 ports)			0.2		24
	- 5 ports				1	24
	- 1 - 4 ports				0.5	12
2	Seawaters where freedom to maneuver is limitted within the coverage	0.2				150
	① Dangers, Reef, Atoll			0.6		90
	- 3 areas or more				1	90
	- 1 - 2 areas				0.5	45
	② Narrow channel with crossing point			0.4		60
	- 2 area or more				1	60
	- 1 area				0.5	30
3	Marine Casualties	0.2				150
	① Aground or Collision			0.8		120
	- 2 times or more				1	120
	- 1 time				0.5	60
	② Sunken or Flooding			0.2		30
	- 5 times or more				1	30
	- 1 - 4 times				0.5	15
4	Nunber of Traffic Routes within the coverage of DGPS	0.2				150
	① Tanker and/ or Passengers			0.6		90
	- 35 routes or more				1	90
	- 17 - 34 routes				0.5	45
	- 1 - 17 routes				0.25	22.5
	② Container or Bulk Cargo			0.3		45
	- 18 routess or more				1	45
	- 9 - 17 routes				0.5	22.5
	- 1 - 9 ships				0.25	11.25
	③ Pioneer Ship			0.1		15
	5 ships or more				1	15
	1- 5 ships				0.5	7.5
5	Sea-lanes within the coverage area	0.2				150
	① Entrance or Veering Point near from coastal line (within 20NM)			0.6		90
	- 2 points ormore				1	90
	- 1 point				0.5	45
	② Number of veering points within coverage area			0.3		45
	- 3 points or more				1	45
	- 1 - 2 points				0.5	22.5
	③ Total length of sea-lane within coerage area			0.1		15
	- 250 or more				1	15
	- 1- 250 nautical miles				0.5	7.5
6	Forecast of Demand in Coverage Area as of Year 2020	0.1				100
	① 50,000 ships, or more				1	100
	② 10,000 ships or more				0.5	50
	③ Less than 10,000 ships				0.25	25
	Total	1				1000

③ Situation of preservation of environment and respect of human life at sea through number of designated traffic routes by type of ship that is;

- Tankers and Passenger ships,
- Container ships and Bulk cargo ships, and
- Pioneer service

④ Situation of the safety navigation in and around sea lanes, that is;

- Entrance or veering point of the sea lane, which is close to shore within 20nuatical miles.
- Number of veering points of the sea lane
- Length of the sea lane

⑤ Situation of forecast of demand
The forecast of demand was made on the basis of data studied by the Study Team and described in the **Chapter 8** of **Main Report Volume 1: Part 1.**

The data source for evaluation is DGSC except for “Vessel Volume” .

(2) Result of Evaluation

The results of evaluation of waters proposed for DGPS are shown in **Table 1.2.3.**

The result of evaluation shows that some proposed waters to be covered by DGPS stations are low scores for the following reasons;

① Number of DGSC strategic ports and main ports for passenger ships is small within the waters to be covered by the proposed DGPS stations.
② Number of main ports under the plan of SYSTRANAS is small with in the waters to be covered by the proposed DGPS station.
③ Traffic volume is smaller than other waters.
④ Number of marine casualties is small compared with other waters,
⑤ Vessel volume as of year 2020 is low.

There are small scale ports in three (3) proposed waters to be covered by No.14, No.21 and No.22 of DGPS stations that are co-sited at the coastal radio station Tarakan, Jayapura and Merauke.

The waters around west entrance of Malacca Strait are covered by the DGPS stations operated or to be operated in year 2002 by neighboring countries that are Malaysia and India.

Table 1.2.3. Evaluation Sheet for Selection of Waters covered by DGPS

No / Item	Score	Seawaters to be evaluated for Selection of DGPS Coverage Area																					
		1. Sabang	2. Belawan	3. Telk Bayur	4. Dumai	5. Palembang	6. Jakarta	7. Semarang	8. Surabaya	9. Benoa	10. Kupang	11. Pontianak	12. Banjarmasin	13. Balikpapan	14. Tarakan	15. Makassar	16. Pantoloan	17. Kendari	18. Bitung	19. Ambon	20. Sorong	21. Jayapura	22. Merauke
1	300	111	234	111	222	204	270	243	237	159	120	150	168	138	93	150	138	81	177	93	120	72	57
1-1	180	81	162	81	162	162	162	135	153	117	90	108	108	90	81	108	108	63	117	63	90	54	45
①	90	45	90	45	90	90	90	90	90	45	45	45	45	45	45	45	45	45	45	45	45	45	0
②	54	27	54	27	54	54	54	27	54	54	27	54	54	27	27	27	27	0	54	0	27	0	27
③	36	9	18	9	18	18	18	18	9	18	18	9	9	18	9	36	36	18	18	18	18	9	18
1-2	120	30	72	30	60	42	108	108	84	42	30	42	60	48	12	42	30	18	60	30	30	18	12
①	60	0	30	0	0	0	60	60	60	0	0	0	0	0	0	30	0	0	30	0	0	0	0
②	36	18	18	18	36	18	36	36	0	18	18	18	36	36	0	0	18	18	18	18	18	18	0
③	24	12	24	12	24	24	12	12	24	24	12	24	24	12	12	12	12	0	12	12	12	0	12
2	150	75	45	45	105	75	75	45	105	120	75	120	75	120	45	120	45	105	75	45	150	45	45
①	90	45	45	45	45	45	45	45	45	90	45	90	45	90	45	90	45	45	45	45	90	45	45
②	45	30	0	0	60	30	30	0	60	30	30	30	30	30	0	30	0	60	30	0	60	0	0
3	150	15	75	60	150	75	150	90	150	135	75	75	90	90	15	150	75	135	75	15	75	15	15
①	120	0	60	60	120	60	120	60	120	120	60	60	60	60	0	120	60	120	60	0	60	0	0
②	30	15	15	0	30	15	30	30	30	15	15	15	30	30	15	30	15	15	15	15	15	15	15
4	150	33.75	63.75	63.75	56.25	67.5	135	135	108.75	108.75	41.25	63.75	108.75	101.25	33.75	115.25	63.75	115.25	63.75	63.75	71.25	41.25	41.25
①	90	22.5	45	45	45	45	90	90	90	90	22.5	45	90	90	22.5	90	45	90	45	45	45	22.5	22.5
②	45	11.25	11.25	11.25	11.25	22.5	45	45	11.25	11.25	11.25	11.25	11.25	11.25	11.25	11.25	11.25	11.25	11.25	11.25	11.25	11.25	11.25
③	15	0	7.5	7.5	0	0	0	0	7.5	7.5	7.5	7.5	7.5	0	0	14	7.5	14	7.5	7.5	15	7.5	7.5
5	150	0	0	0	0	0	105	0	0	120	105	105	0	30	0	150	30	0	60	150	0	0	0
①	90	0	0	0	0	0	45	0	0	90	45	45	0	0	0	90	0	0	0	90	0	0	0
②	45	0	0	0	0	0	45	0	0	22.5	45	45	0	22.5	0	45	22.5	0	45	45	0	0	0
③	15	0	0	0	0	0	15	0	0	7.5	15	15	0	7.5	0	15	7.5	0	15	15	0	0	0
6	100	25	100	50	100	100	100	50	100	50	100	50	100	100	100	100	25	100	100	100	50	50	50
Total	1000	259.75	517.75	329.75	633.25	521.5	835	563	700.75	692.75	516.25	563.75	541.75	579.25	286.75	785.25	376.75	536.25	550.75	466.75	466.25	223.25	208.25
Class of SROP		II	I	II	I	I	I	II	I	III	II	III	II	II	III	I	III	III	I	I	II	I	III
Sea-lane's Priority		-	-	-	-	-	1	-	-	2	3	1	-	2	-	2	2	-	3	3	-	-	-
Priority		20	13	18	5	12	1	8	3	4	14	7	10	6	19	2	17	11	9	15	16	21	22

DGPS stations operated by Singapore and to be operated by Malaysia in year 2002 cover TSS in Malacca and Singapore Straits.

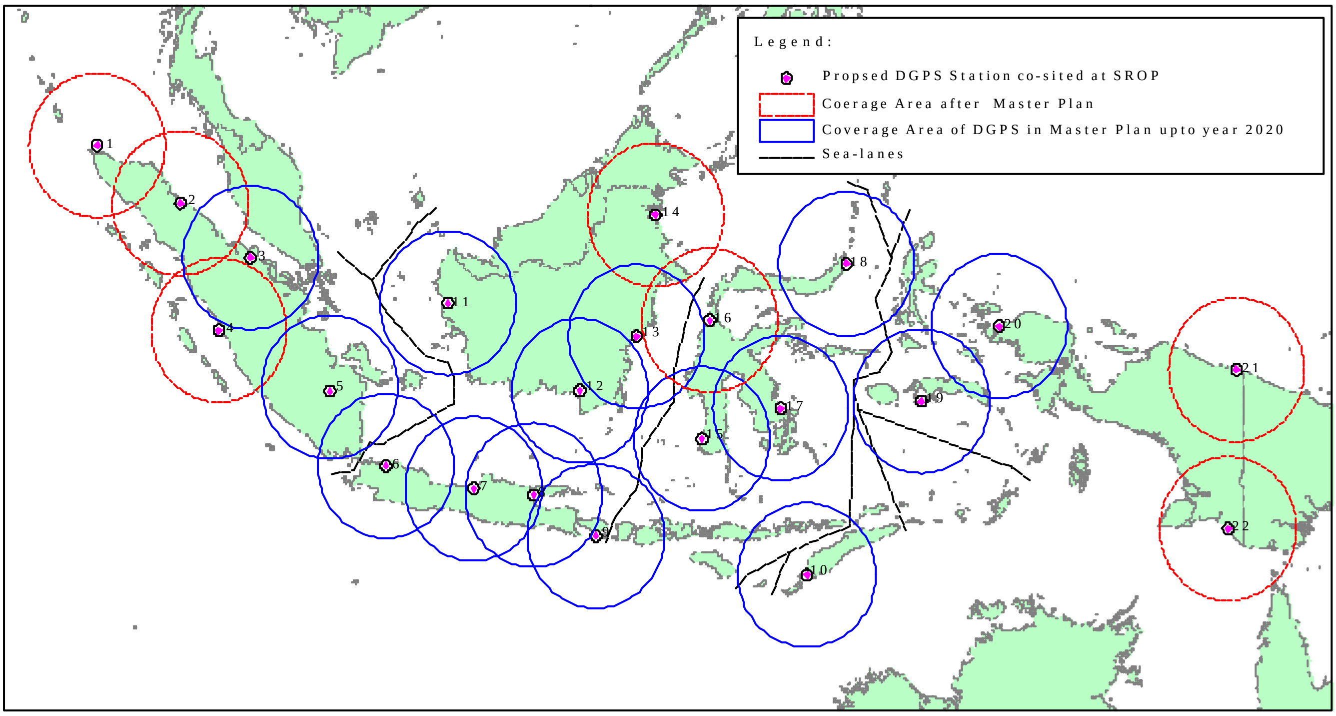
No.13 proposed DGPS station to be co-sited at Balikpapan Coastal Radio Station could cover the waters around north entrance of Sea Lane II or Makassar Strait.

As a result of the evaluation of proposed waters, the Study Team proposed the Master Plan on DGPS Stations in Indonesia up to year 2020 to develop around:

① Sea lanes,
② Waters where maneuverability is limited by such as dangers such as atolls and narrow straits with crossing point,
③ Waters including major ports and harbors specified by DGSC Strategic ports and under SYSTRANAS, and
④ Waters where traffic volume of passenger and cargo is large scale.
⑤ Proposed DGPS station No.3 is established to cover the blind area out of coverage area of DGPS operated by neighboring countries.

Accordingly, the following fifteen (15) DGPS stations are to be established around three (3) sea lanes and Jawa Sea at first. The Master Plan on DGPS station targets to establish around three (3) sea lanes, Jawa Sea, Batanta and Benkalis Strait, Banka Strait and West of Irian Jaya up to year 2020. The proposed Master Plan on DGPS stations in Indonesia is shown in **Figure 1.2.5**.

Figure 1.2.5. Proposed DGPS Station in Master Plan



Locations of fifteen (15) DGPS stations proposed in the Master Plan up to year 2020 is shown in **Table 1.2.4**. In this Table, number of the proposed DGPS stations is complied with number given in **Figure 1.2.5.**

Table 1.2.4. Location of Proposed DGPD Stations in Indonesia up to Year 2020

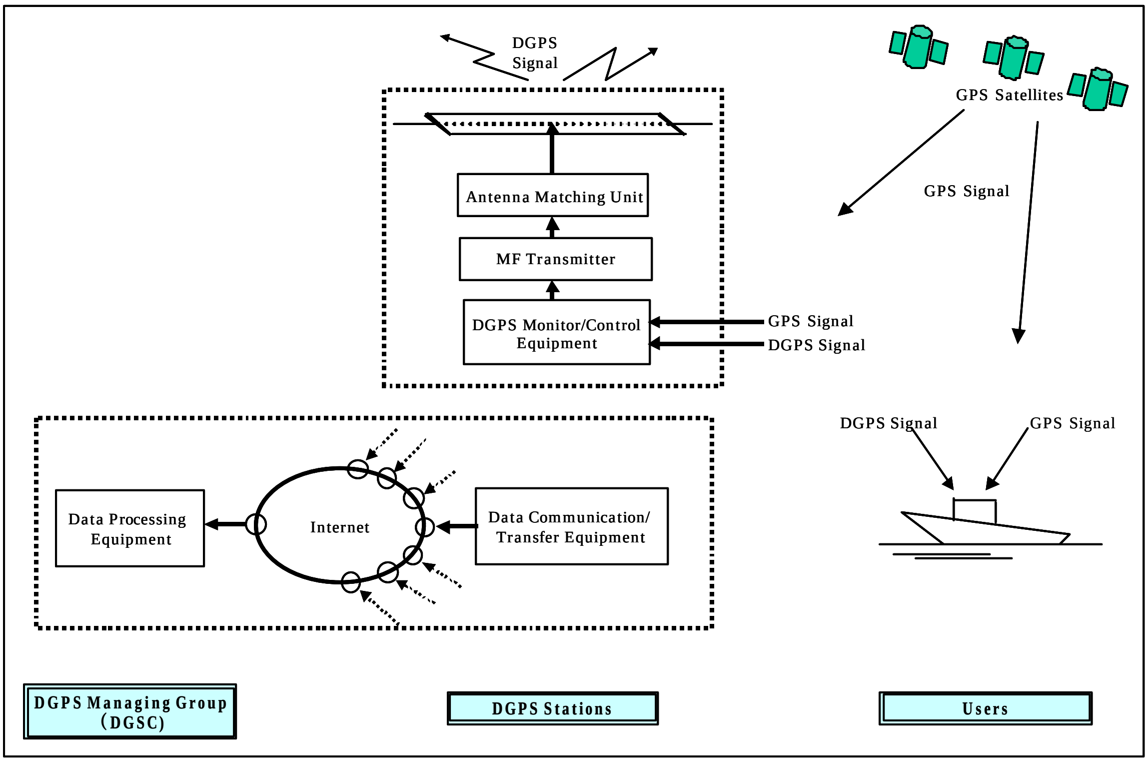
NO	NAME	CLASS	LATITUDE	LONGUITUDE	PROVINCE
3	Dumai	I	01-41-10N	101-27-20E	Riau
5	Palembang	I	02-58-08S	104-46-44E	Sumatera Selatan
6	Jakarta	I	06-07-08S	106-51-47E	DKI Jakarta
7	Semarang	II	06-58-34S	110-20-35E	Jawa Tengah
8	Surabaya	I	07-13-05S	112-44-08E	Jawa Timur
9	Benoa	III	08-44-35S	115-12-32E	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

1.2.4. DGPS System Outline

The DGPS system is composed mainly of "DGPS transmitting system" and "DGPS monitoring system" as shown in **Figure 1.2.6.** 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 fifteen (15) stations.

Power supply system and air-conditioners are improved or reinforced in consideration of actual situation of each station. 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 1.2.6. DGPS System Outline



1.2.5. Operation, Maintenance and Management System Plan

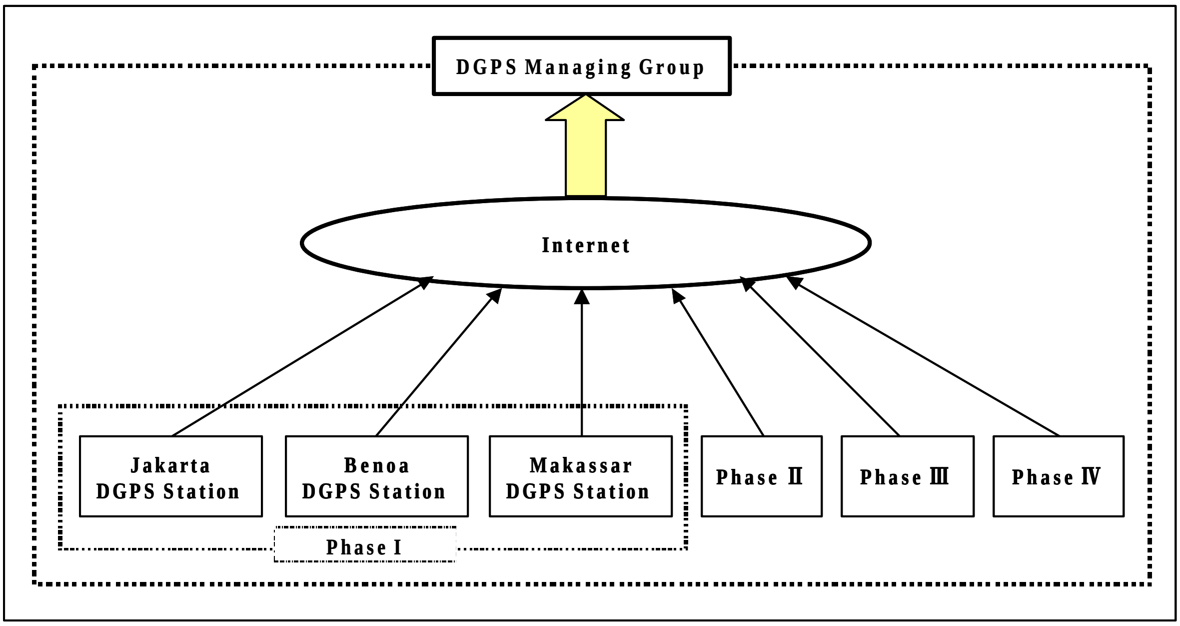
Most of the existing MFB stations constructed under the Japanese Yen Loan had been suspended their operation several years after their starts because of lack of operation and maintenance costs and weakness of operation and maintenance management system.

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 1.2.7.**

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 1.2.7. DGPS Operation and Maintenance System Plan



1.2.6. Allocation Plan of Main Equipment

Allocation plan of main equipment for fifteen (15) stations is shown in **Table 1.2.5.**

Table 1.2.5. Allocation Plan of Main Equipment

Main Equipment	JKT	SMG	BNA	MKS	BPN	BJM	PTK	DMI	PLG	SBY	KPG	KDR	ABN	SRG	BTG	DMG
1. DGPS Transmitting System																
(1) Transmitting Antenna	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
(2) Antenna Matching Unit	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
(3) Antenna tower	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
(4) MF Transmitter	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
(5) DGPS Monitor/Control	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
(6) Software for (5) above	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
2. DGPS Monitoring System																
(1) Data Process. Equipment																○
(2)Data transfer Equipment	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
(3) Software for (2) above	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
3. Power supply system																
(1) Engine Generator			○	○			○									
(2) Isolation transformer			○		○	○	○				○	○				
(3) Auto. Voltage Regulator			○		○	○	○				○	○				
(4) Step-up/down	○			○	○	○										
4. Interference Protection Equipment			○				○				○	○				
5. Associated facility																
(1) Anti-lightning facility			○	○			○									
(2) Air conditioner				○	○	○										
6. Operation & Maintenance Equipment	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
7. Spares	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

Note: JKT:Jakarta, SMG:Semarang, BNA:Benoa, MKR:Makassar, BPN:Balikpapan, BJM:Banjarmasin, PTK:Pontianak, DMI:Dumai,PLG:Palembang, SBY:Surabaya, KPN:Kupang,KDR:Kendari,ABN:Ambon,SRG:Semarang,BTN:Bitung, JKT:Jakarta

1.2.7. Implementation Schedule

The implementation schedule of DGPS station up to year of 2020 is shown in **Table 1.2.6.**

Table 1.2.6. 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															

1.2.8. Cost Estimate

The cost estimate is applied for the project cost and operation and maintenance cost as shown in **Table 1.2.7.**

The cost estimate is divided into Local Currency and Foreign Currency phase by phase.

Table 1.2.7. 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	277
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	7,662	8,330	9,201	30,572
9. Contingency (5%)	269	383	416	460	1,528
Total	5,648	8,045	8,746	9,661	32,100

1.2.9. Radar Beacon (Racon) Stations

The development and improvement of the Racon stations in the Master Plan was planned in consideration of the following purposes and advantages:

① Availability ② Long range navigation

② Landfall marks ④ Inconspicuous coast line marking

⑤ Off shore danger or structure ⑥ Routing scheme

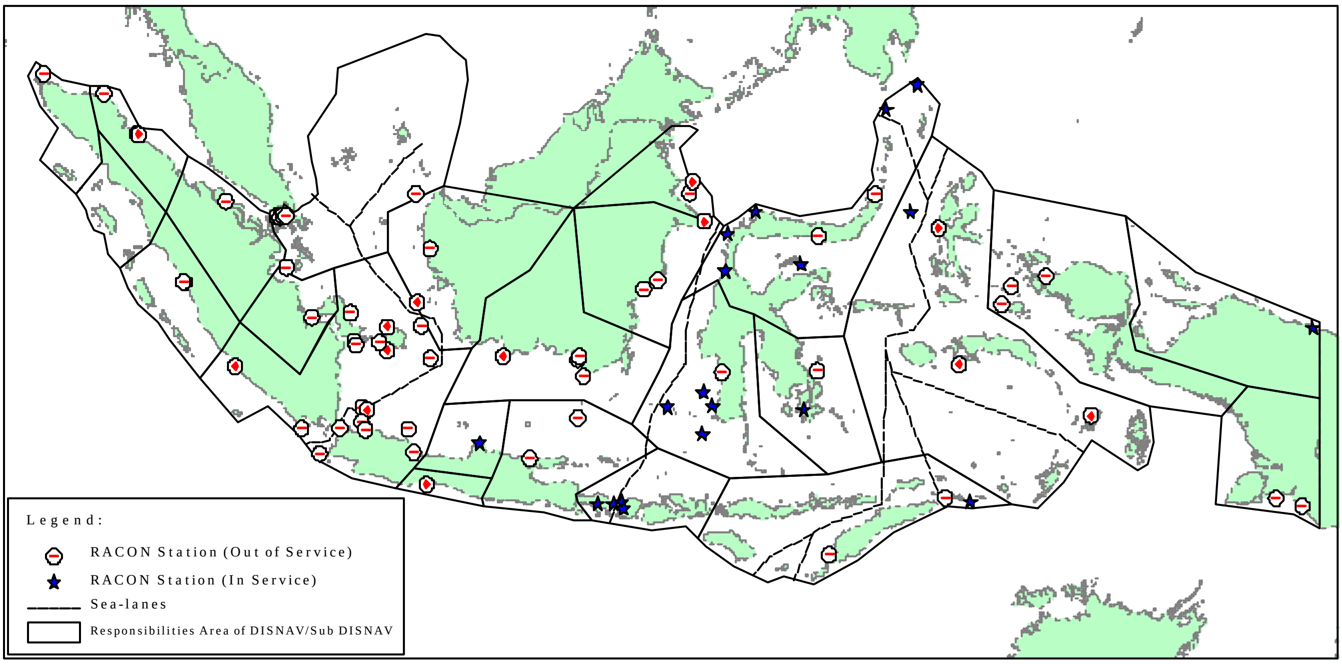
⑦ Turning mark

Some of Racon Stations 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.

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 Racon stations in Indonesia are shown in **Figure 1.2.8.**

Figure 1.2.8. Location and Current Situation of RACON



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.

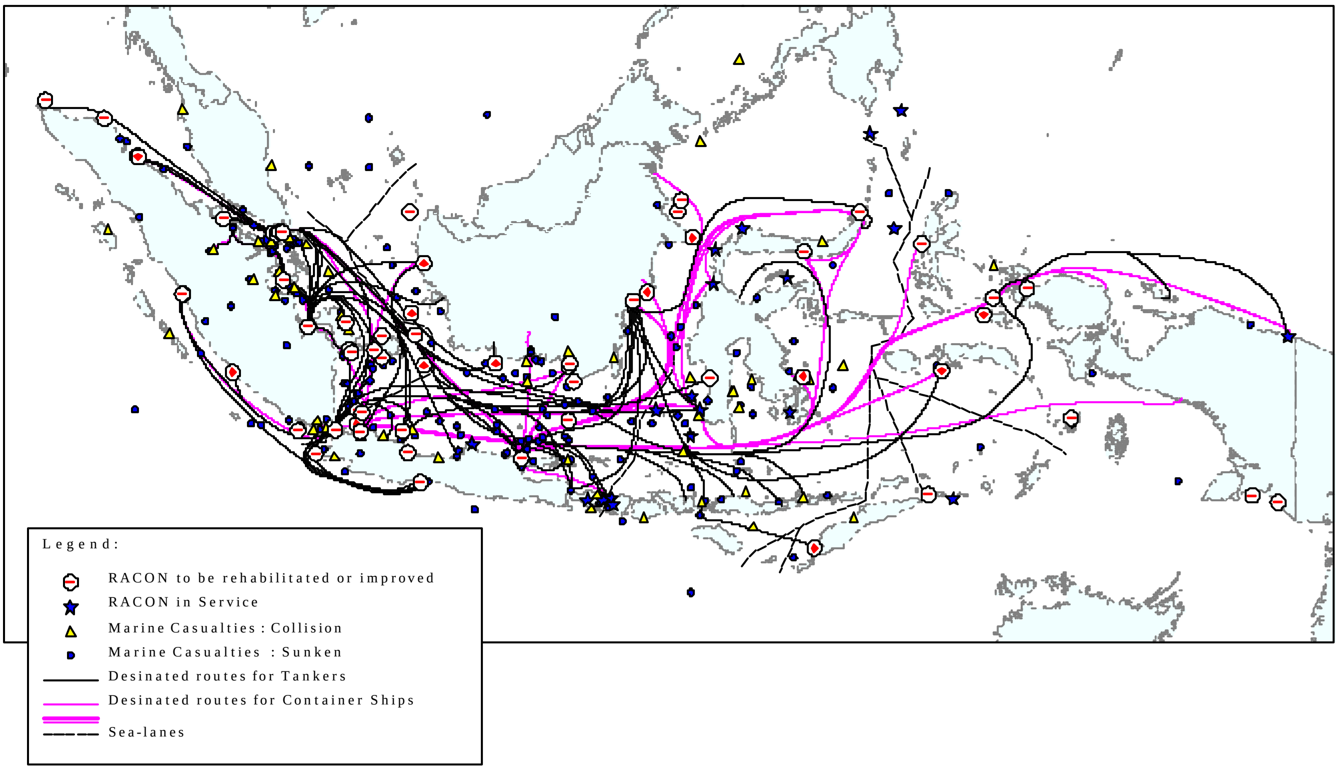
As shown in **Figure 1.2.8.,** all Racon stations co-sited with lighthouses and light beacons around Sea Lane I from south entrance to north entrance has been damaged, but twenty (20) Racon stations around Sea Lane II are in service. For the formulation of master plan up to year 2020 for the Racon stations, the following points were considered:

- To cover the three (3) sea lanes
- To co-site with the lighthouse or light beacon
- To consider the marine causalities cased around sites
- To consider the situation of port development
- To consider the designated traffic route

As shown in **Figure 1.2.9.**, Racon stations in Indonesia locates at the end of designated traffic routes of tanker, passenger ships and container ships. Those Racons are mostly utilized as landfall marks to give ships position. These are utilized to approach the major ports such as DGSC strategic ports and main ports under SYSTANAS.

Some Racon stations are co-sited with the off shore lighthouses and light beacons adjacent to the veering point or close point about 10 miles to 30 miles from axis line or side line of sea lane. These Racons are utilized as a danger marks to give ships existence of dangers, atolls and so forth.

Figure 1.2.9. Traffic Routes and Marine Casualties around RACON



The Study Team confirmed effectual utilization during the Site Survey and the Survey of Inventory.

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 improvement and rehabilitation of Racon stations are planned on the basis of the following concept:

① To rehabilitate and improve the Racon stations located around sea lanes and they are utilized mainly for danger marks.
② To rehabilitate and improve the Racon stations located at major ports and main ports under SYSTRANAS as landfall marks.
③ To plan the implementation schedule of rehabilitation and improvement project after completion of rehabilitation of lighthouses and light beacons that Racon equipment is co-sited with or annexed to.

The rehabilitation and improvement plan was made for the following Racon stations:

① Rehabilitation criteria of Racon station

Danger Mark

- 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. These locations and lighted aids that co-site with Racon stations are shown in **Table 1.2.8.** as danger marks for the sea lanes and **Table 1.2.9.** as landfall mark for port and harbor approach.

Table 1.2.8. Allocation Plan of RACON Stations (Danger Mark)

No.	No of List of Light	Code	Lighted VATN co-sited	Latitude	Longitude	Purpose	Remarks
1	1700	B	Beting Raja (Amemuiden droogt	05-12-30 S	106-44-20 E		No1 Sea-lane
2	1710	B	Beting Eka (Etnadroogte)	05-17-32 S	106-54-30 E		No1 Sea-lane
3	1960	*	Discovery East Bank Gosong Ma	03-35-00 S	109-10-00 E		No1 Sea-lane
4	2000	G	P. Pasemut	02-29-50 S	108-50-33 E		No1 Sea-lane
5	2020	T	Serutu	01-43-00 S	108-42-00 E		No1 Sea-lane
6	2230	G	Tg. Layar	06-45-00 S	105-12-30 E		No1 Sea-lane
7	2280	T	Tempurung	05-54-03 S	105-55-45 E		No1 Sea-lane
8	2290	B	Belimbing	05-55-30 S	104-33-30 E		No1 Sea-lane
9	1700	B	Beting Raja (Amemuiden droogt	05-12-30 S	106-44-20 E		No1 Sea-lane
10	1710	B	Beting Eka (Etnadroogte)	05-17-32 S	106-54-30 E		No1 Sea-lane
11	1960	*	Discovery East Bank Gosong Ma	03-35-00 S	109-10-00 E		No1 Sea-lane
12	2000	G	P. Pasemut	02-29-50 S	108-50-33 E		No1 Sea-lane
13	2020	T	Serutu	01-43-00 S	108-42-00 E		No1 Sea-lane
14	2230	G	Tg. Layar	06-45-00 S	105-12-30 E		No1 Sea-lane
15	2280	T	Tempurung	05-54-03 S	105-55-45 E		No1 Sea-lane
16	2290	B	Belimbing	05-55-30 S	104-33-30 E		No1 Sea-lane
1	4163	G	Menara Suar Giliselang	08-23-50 S	115-43-00 E		No2 Sea-lane
2	4176	M	Menara Suar Bukit Badung	08-23-50 S	115-08-38 E		No2 Sea-lane
3	4178	K	Menara Suar Gili Trewangan	08-21-00 S	116-01-28 E		No2 Sea-lane
1	5365	*	Menara suar Mayu	01-19-10 N	126-21-32 E		No3 Sea-lane
2	5441	*	Marore	04-44-30 N	125-28-30 E		No3 Sea-lane
3	5716	M	Menara suar Letty	08-13-05 S	127-36-05 E		No3 Sea-lane
4	5365	*	Menara suar Mayu	01-19-10 N	126-21-32 E		No3 Sea-lane
5	5441	*	Marore	04-44-30 N	125-28-30 E		No3 Sea-lane
6	5716	M	Menara suar Letty	08-13-05 S	127-36-05 E		No3 Sea-lane

Table 1.2.9. Allocation Plan of RACON Stations (Landfall Mark)

No.	No of List of Light	Code	Lighted VATN co-sited	Latitude	Longitude	Purpose	Remarks
1	120	K	Tg. Jambo Aye Diamont punt	05-14-51 N	097-29-17 E		Main Port
2	315	N	Nipah Larangan	03-54-14 N	098-40-37 E		Main Port
3	341	M	Belawan Deli	03-52-19 N	098-44-13 E		Main Port
4	650	D	Ramsu Tg. Leban	01-39-30 N	101-50-30 E	Danger	Main Port
5	1310	M	Sungai Palembang	02-12-50 S	104-55-42 E		Main Port
6	1720	D	Damar Besar	05-57-30 S	106-50-30 E	Danger	Main Port
7	2040	K	Ramsu Kapuas Kecil Depan	00-04-21 N	109-10-13 E		Main Port
8	2490	T	Tikus	03-50-30 S	102-11-00 E		Main Port
9	2570	M	Mensu. Os. Beramas	01-02-30 S	100-22-30 E		Main Port
10	2990	T	P Boompies, P. Rakit	05-56-16 S	108-22-58 E		Main Port
11	3020	G	Cirebon	06-43-00 S	108-34-30 E		Main Port
12	3400	K	Karang Jamuang	06-55-35 S	112-43-42 E		Main Port
13	4100	K	Mensu PP Cimiring N.K	07-46-59 S	109-02-29 E		Main Port
14	4363	B	Ma. Sungai Barito	03-36-42 S	114-27-07 E		Main Port
15	4370	B	Sungai Barito Belakang	03-31-16 S	114-30-08 E		Main Port
16	4730	T	Tukong Hill	01-16-30 S	116-48-30 E		Main Port
17	4741	M	Kutai River (Ma. Pegah)	00-58-44 S	117-18-57 E		Main Port
18	5040	M	Tg. Lero Pare Pare	04-02-54 S	119-36-38 E		Main Port
19	5390	T	Mensu Talise	01-53-10 N	125-05-40 E		Main Port
20	5586	K	Mensu tanjung Pawali	03-59-50 S	123-01-00 E		Main Port
21	5800	B	Menara suar Tg. Kurung	10-07-30 S	123-26-30 E		Main Port
22	5920	N	Nusanive	03-47-30 S	128-05-30 E		Main Port
23	6000	M	Merauke	08-30-00 S	140-22-30 E		Main Port
24	6130	K	Tg Suaja	02-31-51 S	140-44-40 E		Main Port
25	6341	*	Menara suar P. Buaya	00-50-20 S	131-12-26 E		Main Port

Implementation schedule of the Racon stations are shown in **Table 1.2.10.**

Table 1.2.10. 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 1.2.11** .

Table 1.2.11. 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

1.3. Supporting Facilities for Aids to Navigation

1.3.1. Role of Supporting Facilities for Aids to Navigation Services

Role of supporting facilities for aids to navigation service is to maintain the regular operation of aids to navigation facilities. Regular operation of aids to navigation facilities is maintained by the careful daily maintenance work.

However, for the unmanned facilities such as light beacons, lighted buoys and so on, it is not possible to execute maintenance work every day. For the maintenance work for these facilities are carried out by periodical visiting maintenance. Usually, as the most of aids to navigation facilities are constructed at the location near the coast and far from the maintenance office, access to the site from land is mostly difficult.

Therefore, utilization of vessel is very convenient and economical way for maintenance work of aids to navigation services. Other than that, inspection of buoys, exchange work of gas cylinder and inspection of off shore light beacons have to utilize the vessel. Accordingly, vessels are essential facility to maintain the aids to navigation facilities.

When some fault was found in the lighting equipment and/or relating apparatus of these facilities, and it was difficult to repair the fault within the limited time of schedule of maintenance on sites, the parts have to be carried back to the land base.

Workshop is the station to carry out these repairing works. Machine tools, measurement instrument, painting equipment, transporting facilities and so on shall be provided in the workshop.

Another important supporting facility for aids to navigation service is Buoy Base. Because buoy is floating in watershellfish are adhere to the underwater part of buoy body for a long time, and causes the corrosion of buoy body. Therefore, buoys have to be pulled up from seawater periodically and transported to the buoy base for maintenance work on land. Sometimes, it is damaged by collision with a vessel. In such a case, damaged buoy body, equipment and superstructure etc. are transported to the buoy base and repaired, and replaced one by one after a completion of maintenance work on land.

Buoy Tender is the vessel specially built for this purpose, and is also the important supporting facility for aids to navigation services. Several spare buoy bodies are provided to a buoy base, and replaced one by one after finishing of maintenance work. As the buoy body is relatively large, so the buoy base should have wide-open area for repairing and other maintenance work and storage area for buoy body, mooring chain and sinkers.

Vessels of other than buoy tender such as aids tender and inspection boat are required in order to provide the periodical maintenance and inspection works for aids to navigation facilities, and supply the goods to lighthouse such as fuel oil for lighthouse, daily living necessities for lighthouse keepers and gas bottles for light beacons and light buoys.

In addition to the facilities above, jetty is necessary as facilities for smooth and prompt loading and unloading works between vessel and land facilities such as buoy base. All these facilities mentioned above are called as supporting facilities.

1.3.2. Vessels

1.3.2.1. 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 1.3.1.**

As shown in **Appendix 1.3.1,** vessels aged less than 16 years are 15, vessels aged between 16 and 25 years are 7, vessels aged between 26 and 35 years are 25, vessels aged between 36 and 40 years are 8, and vessels aged more than 40 years are 20. This means that more than one third of the vessels for aids to navigation service are older than 36 years.

Technical condition indicates the state of vessel’s functional capability. It is evaluated by relative condition of hull, main engine, navigational instrument and other installed equipment to original condition. It is considered that the vessel which technical condition is less than 80% will not be able to execute her duty satisfactorily. Vessels under this situation are reached to 58 vessels, which occupy 77.3 % of whole vessels. Vessels which technical condition is less than 40% will have to be retired before long.

Table 1.3.1. Number of Vessels by Type and Class

As of July 31, 2001

DISNAV	No	Type of Vessel / Class	Survey Vessel I	Buoy Tender I	Aids Tender (incl. Supply Vessel) I	Aids Tender II	Aids Tender III	Aids Tender IV	Inspection Boat II	Inspection Boat III	Inspection Boat IV	Total
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			

As shown in **Appendix 1.3.1**, it is planed that DGSC will scrap 29 vessels for aids to navigation services up to the end of 2003.

The plan is based on the years after built of the vessel. As the target of this figure, 40 years is adopted. But it seems somewhat shorter judging from the situation of finance at present. So, it is recommendable to prolong the operational period of several vessels selected among these 29 vessels by giving the appropriate repairing work, and then elaborate again the unstrained scrapping plan.

1.3.2.2. Proposed Scrapping Plan

The proposed scrapping plan is shown in the **Table 1.3.2.** This plan is based on the life of vessel as 45 years. The detailed scrapping plan is shown in **Appendix 1.3.2.**

Table 1.3.2. 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	

1.3.2.3. Rehabilitation Plan of Vessels

The rehabilitation plan of vessels for aids to navigation services up to year of 2020 is shown in **Table 1.3.3.** The detail is shown in **Appendix 1.3.2.**

Table 1.3.3. 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

1.3.2.4. Development Plan up to year of 2020

(1) Minimum number of Vessels for aids to navigation services

DGSC has estimated the minimum number of required vessels for aids to navigation services judging from the workload of each DISNAV. This includes the reassignment of vessels under the consideration of each DISNAV's workload at present. The result is shown in **Table 1.3.4.**

Table 1.3.4. Vessels for Aids to Navigation Services

Operation Zone		Minimum Standard per Office				Total
Kind of Offices	Total of Offices	Buoy Tender	Aids Tender	Inspection Boat	Survey Vessel	
DISNAV I	9	1	1	1	-----	27
DISNAV II	9	----	1	1	-----	18
Sub DISNAV	6	----	1	1	-----	12
BTKP	1	----	1	-----	1	2
Total		9	25	24	1	59

(2) Calculation of workload and number of vessel required up to year 2020

The number of aids to navigation facilities expected in the year of 2020 is shown in **Table 1.3.5.** Workload at that time is anticipated to increase to around 42 % more than the workload at present.

Table 1.3.5. Changes of Numbers of Visual Aids to Navigation

Year / ATN	2001	German Ongoing	2020 Development only	Total (units)	Increase Ratio (%)
Lighthouse	235	11	91	337	43
Light Beacon	1,168	23	322	1,513	30
Light Buoy	332	119	157	608	83
Total	1,735	153	570	2,458	42

Equation for basic calculation of the workload of vessels for aids to navigation service is as follows.

Workload = F x { P + SP + (L / 24 x V) + PO} + Work at Site + 10% margin

Where,

			Class I&II	ClassIII&IV	Average
F	:	Frequency of Sailing	See Below		
P	:	Arrangement	3 day	1 day	2
SP	:	Sailing Preparation	6 days	2 days	4
L	:	Route Distance			
V	:	Ship Speed	10 knots	8 knots	9
PO	:	Post Operation	3 days	1 days	2

Frequency of Sailing

Buoy Tender Vessel	Class I	Min. 4	Times Annually
Aids Tender Vessel	Class I,II,III&IV	12	Times Annually
Inspection Boat	Class III&IV	Min. 8	Times Annually

Work days	Buoy Tender and Aids Tender	Inspection Boat
Ship sailing days per vessel	215 days annually	245 days annually
Ship stay in base	90 days annually	90 days annually
Docking	60 days annually	30 days annually

Visit to ATN Site Min. 4 times annually

Criteria of Calculation	Number of visit per year	Working time per unit
	Time/Year	Unit/day
Light House		
Logistic Support	12	4
(Stock Supply and Relief)		
Major Maintenance (Overhaul)	1/4	1
Light Beacon		
Standard Maintenance	4	4
Major Maintenance (Overhaul)	1/4	2
Light Buoy		
Standard Maintenance	4	4
Major Maintenance (Overhaul)	1/4	3
Replace of Buoy	1/2	4

(3) Vessels to be developed up to year 2020

Estimated number of vessels required for aids to navigation services up to year of 2020 is shown in **Appendix 1.3.3**, **Appendix 1.3.4** and **Appendix 1.3.5** based on the result of calculation of workload for every stage at each DISNAV/ Sub DISNAV. According to the estimation above, number of vessels required up to year of 2007 and 2020 is shown in **Table 1.3.6. and Table 1.3.7.** It indicates that the number of vessels required at the end of 2020 is 63, under the assumption that the load of aids to navigation service will increase according to the number of aids to navigation specified in the

Master Plan.

Table 1.3.6. Vessels to be Required up to Year 2007

No.	ATN Office	Class	Number of Vessels available for ATN Services up to 2007									Number of Vessels to be required for ATN Services up to 2007				
					A/T			I/B								
			S/V	B/T	A/T	A/T*	Sub-total	I/B	I/B*	Sub-total	Total	S/V	B/T	A/T	I/B	Total
1	SABANG	Sub			2		2			0	2			1	1	2
2	BELAWAN	II			2	1	3			0	3			1	1	2
3	SIBOLGA	Sub			1		1			0	1			1	1	2
4	DUMAI	I		1	2		2	1		1	4		1	1	1	3
5	TG. PINANG	I		1	3		3	1		1	5		1	1	1	3
6	TLK. BAYUR	II			1		1			0	1			1	1	2
7	PALEMBANG	II				2	2	1		1	3			1	1	2
8	TG.PRIOK	I			4	1	5			0	5		1	1	1	3
9	SEMARANG	II			1	2	3			0	3			1	1	2
10	CILACAP	Sub			2		2			0	2			1	1	2
11	SURABAYA	I		1	1		1	1		1	3		1	1	1	3
12	BENOA	II			1	1	2			0	2			1	1	2
13	PONTIANAK	Sub				1	1	1		1	2			1	1	2
14	BANJARMASIN	II			1		1	2		2	3			1	1	2
15	SAMARINDA	I		1	1		1	1		1	3		1	1	1	3
16	TARAKAN	II				1	1			0	1			1	1	2
17	BITUNG	I			2	1	3			0	3			2	1	3
18	KENDARI	Sub					0			0	0			1	1	2
19	MAKASSAR	I			1	2	3			0	3			1	1	2
20	KUPANG	II			1		1			0	1			1	1	2
21	AMBON	I			1		1			0	1		1	1	1	3
22	JAYAPURA	II			2		2	1		1	3			1	1	2
23	SORONG	I		1	1		1			0	2		1	1	1	3
24	MERAUKE	Sub			1		1	1	1	2	3			1	1	2
25	BTKP	---	1	1			0			0	2	1		1		2
Total			1	6	31	12	43	10	1	11	61	1	7	26	24	58

	S/V	B/T	A/T	I/B	Total
Number of Vessles to be developed by 2007	0	3	4	0	7

Note:

S/V: Survey Vessel　　A/T: Aids Tender

B/T: Buoy Tender　　I/B: Inspection Boat

＊ shows vessel that scrapping should be postponed until year of 2007 at least.

Table 1.3.7. Vessels to be Required up to Year 2020

No.	ATN Office	Class	Number of Vessels available for ATN Services up to 2020					Number of Vessels to be required for ATN Services up to 2020				
			S/V	B/T	A/T	I/B	Total	S/V	B/T	A/T	I/B	Total
1	SABANG	Sub			1		1			1	1	2
2	BELAWAN	II			1		1			1	1	2
3	SIBOLGA	Sub			1		1			1	1	2
4	DUMAI	I			1		1		1	1	1	3
5	TG. PINANG	I		1	2	1	4		1	1	1	3
6	TLK. BAYUR	II			1		1			1	1	2
7	PALEMBANG	II					0			1	1	2
8	TG.PRIOK	I			2		2		1	2	1	4
9	SEMARANG	II			1		1			1	1	2
10	CILACAP	Sub					0			1	1	2
11	SURABAYA	I		1	1		2		1	1	1	3
12	BENOA	II			1		1			1	1	2
13	PONTIANAK	Sub					0			1	1	2
14	BANJARMASIN	II				1	1			1	1	2
15	SAMARINDA	I		1	1	1	3		1	1	1	3
16	TARAKAN	II					0			1	1	2
17	BITUNG	I			1		1		1	2	1	4
18	KENDARI	Sub					0			1	1	2
19	MAKASSAR	I			1		1		1	1	1	3
20	KUPANG	II			1		1			2	1	3
21	AMBON	I			1		1		1	2	1	4
22	JAYAPURA	II			1		1			1	1	2
23	SORONG	I		1	1		2		1	1	1	3
24	MERAUKE	Sub			1		1			1	1	2
25	BTKP	---	1				1	1		1		2
Sub-total			1	4	20	3	28	1	9	29	24	63
Number of Vessels to be developed by 2007			0	3	4	0	7					
Total			1	7	24	3	35					

	S/V	B/T	A/T	I/B	Total
Number of Vessels to be developed by 2020	0	2	5	21	28

Note:

S/V: Survey Vessel
B/T: Buoy Tender
A/T: Aids Tender
I/B: Inspection Boat

The vessels to be required and developed for aids to navigation services up to year of 2020 are summarized in **Table 1.3.8.**

Table 1.3.8. 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

Major mission of vessels for aids to navigation is shown in **Table 1.3.9** below.

Table 1.3.9. Major Mission of Vessel for Aids to Navigation

Mission	Buoy tender	Aids ten Der	Inspection boat	Survey vessel
Operation & Maintenance of aids to navigation facilities	○	○	○	……
Relief of lighthouse keeper	○	○	…..	…..
Equipment supply including fuel etc. to the site	○	○	…..	…..
Inspection of facility	…..	…..	○	…..
Hydrographic and oceanography survey	○	…..	…..	○

Major specifications of vessels for aids to navigation service are shown in **Table 1.3.10**.

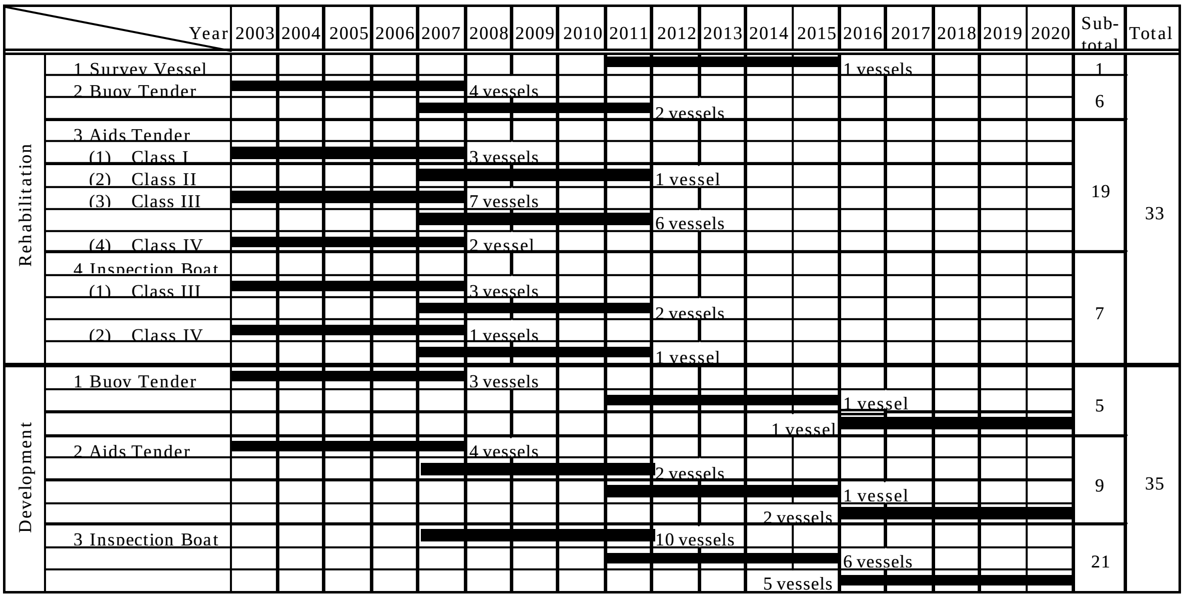
Table 1.3.10. Major Specifications of Vessels for Aids to Navigation Services

Items	Buoy Tender	Aids Tender	Inspection Boat	Survey Vessel
Overall Length (about)	56 m	47 m	22-28 m	67 m
Gross Tonnage (about)	800 GT	550 GT	100 GT	1,400 GT
Cruising Speed (about)	11 knot	11 knot	20 knot	14 knot
Derrick Crane (Max. SWL)	22 ton	12 ton	…..	15 ton
Main Engine	Diesel	Diesel	Diesel	Diesel

1.3.2.5. 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 1.3.11.**

Table 1.3.11. Implementation Schedule for Rehabilitation & Development of Vessels for Aids to Navigation



1.3.2.6. 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 1.3.12.**

Table 1.3.12. 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

1.3.3. Buoy Base and Workshop

As stated above, workshop is very important facility to repair, adjust, measure and improve the equipment brought back from the site of aids to navigation. Machine tools, woodwork machines, hand tools and so on should be provided to the workshop. And also, measurement equipments such as intensity meter, oscilloscope and other apparatus should be kept in good condition.

All DISNAVs/ Sub DISNAVs except Tarakan have a workshop. However, it seems that the area of these workshops is not sufficient to their needs. There are some workshops which area is only 80m^2.

Almost all kinds of tools and machines of workshop have aged and become too old, and it is desirable to replace with new ones that have proper functions for repairing work and so on being in line with current aids to navigation services as early as possible.

Buoy base should have the sufficient area for maintenance work and storage area for buoy. There are nine (9) buoy bases in total. However, spaces of those except several buoy bases are insufficient for the maintenance work to be required at present.

1.3.3.1. Criteria of Buoy Base and Workshop

Standard area for workshop, buoy base and related facilities of DISNAV/ Sub DISNAV is given as follows:

(1) Buoy Base

No.	Item	Class I	Class II
1)	Storage Space for Buoy Body with Superstructure	1500 m^2	500 m^2
2)	Storage Space for Sinkers	260 m^2	80 m^2
3)	Painting work area	260 m^2	80 m^2
4)	Cleaning work area	260 m^2	80 m^2
5)	Welding work area	260 m^2	80 m^2
6)	Assembling, Testing & Inspection Area	120 m^2	60 m^2
7)	Paved area	260 m^2	80 m^2
8)	Incinerator	80 m^2	40 m^2
Total		3000 m^2	1000 m^2

(2) Open Storage

No.	Item	Class I	Class II
1)	Main Chains	150 m^2	75 m^2
2)	Bridle Chains and Sinker Connecting Chains	50 m^2	25 m^2
Total		200 m^2	100 m^2

(3) Workshop

No.	Item	Class I	Class II
1)	Machine tools	510 ㎡	310 ㎡
2)	Wood work machine	175 ㎡	80 ㎡
3)	Welding machine	110 ㎡	55 ㎡
4)	Bench tools	55 ㎡	35 ㎡
5)	Storage & work space for electronic equipment	80 ㎡	60 ㎡
6)	Generator Set	70 ㎡	60 ㎡
	Total	1000 ㎡	600 ㎡

(4) Storage

No.	Item	Class I	Class II
1)	Spares for lighting equipment	100 ㎡	40 ㎡
2)	Spares for power supply system	100 ㎡	40 ㎡
3)	Spares for workshop equipment	100 ㎡	40 ㎡
4)	Testing & measuring equipment	60 ㎡	40 ㎡
5)	Compressor & pump	60 ㎡	40 ㎡
6)	Handling equipment	180 ㎡	100 ㎡
7)	Painting materials	100 ㎡	40 ㎡
8)	Gas cylinders	80 ㎡	40 ㎡
9)	Fuel	80 ㎡	40 ㎡
10)	Materials for periodical maintenance trip	80 ㎡	50 ㎡
11)	Associated materials for ATN services	60 ㎡	30 ㎡
	Total	1000 ㎡	500 ㎡

(5) Length of Jetty

No.	Item	Class I	Class II
1)	Buoy Tender	56m	-----
2)	Aids Tender	*	47m
3)	Inspection Boat	*	*
	Total	80m	60m

Note: * shows to bring stern on vessel to jetty.

Proposed standard of buoy base and workshop at the target year of 2020 is summarized in **Table 1.3.13.**

Table 1.3.13. Standard of Workshop and Buoy Base

No.	Items	Class I	Class II
1	Buoy Base	3000 m^2	1000m^2
2	Open Storage	200m^2	100m^2
3	Workshop	1000m^2	600m^2
4	Storage	1000m^2	500m^2
5	Jetty	80m	60m

1.3.3.2. Master Plan on Buoy Base and Workshop

(1) Buoy base

Buoy base needs sufficiently broad space to keep buoy bodies, mooring chain, shackles and sinkers, and to carry out the buoy maintenance work such as removing of rust, repairing, welding, painting and so on.

At present, nine (9) buoy bases and six (6) buoy tenders are taking charge of maintenance of all buoys in whole area of Indonesia.

It is considered that the buoy base should be established to each DISNAV up to the year of 2020, to improve the efficiency of vessel's activity and keep the buoys for aids to navigation always in a good condition.

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

At present, all DISNAVs except Tarakan have their own workshop. However, the installed machine tools and other equipments to most workshops have become too old, and working space and parts storing space of several workshops are not sufficient for the work. Therefore, each workshop has to be improved respectively.

1) Workshop and Storage

The workshops 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)

Standard of workshop equipment for each DISNAV/Sub DISNAV is shown in **Table 1.3.14.**

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)

Table 1.3.14. Outline of Workshop Equipment

No.	Equipment	Main Specification	Workshop Class Ⅰ	Workshop Class Ⅱ	B T K P
A	MACHINE TOOLS				
1	Lathe	2000 x 250 mm	2	1	1
2	Precision Lathe	400 x 50 mm	1	1	1
3	Universal Milling Machine	270 x 1350 mm	1	1	--
4	Vertical Milling Machine		1	--	--
5	Radial Drilling Machine	0 40 mm	1	--	--
6	Vertical Drilling Machine	0 25 mm	2	1	1
7	Bench Drilling Machine	13 mm	2	1	1
8	Shaping Machine	Stroke 500 mm	1	1	1
9	Hack Saw Machine	ö 350 mm	2	1	1
10	Bench Grinder	ö 250 mm,3000rpm	2	2	1
11	Bending Machine	1800 x 15 mm	1	1	1
12	Shearing Plat	1800 x 15 mm	1	1	--
13	Press Machine	25ton	1	1	1
14	Pipe Bender	ö 80 mm	1	1	1
15	Combined Punching And Shearing Machine	Thickness 16 mm, ö 28 mm	1	1	--
16	Table Circular Saw	Min 100mm,2800rpm	1	1	1
B	WOOD WORK MACHINE				
1	Wood Milling Machine	500 x 2000 mm	1	1	1
2	Wood Band Saw	500 x 2000 mm	1	1	1
3	Circular Saw	Table 220 mm	1	1	1
4	Wood Lathe	400 x 1000 mm	1	--	--
5	Multipurpose Wood Work Machine		1	--	--
6	Profile Wood Machine		1	1	--
7	Jig saw	220 - 400 V / 50 - 60 Hz	1	1	--
C	WELDINGS MACHINE				
1	Engine Welder	200 kVA, 300 A	3	2	1
2	Acetylene Gas Set	Complete set	2	1	1
3	Welding Transformer	16kVA, 260 A	2	1	1
D	COMPRESSOR AND PUMP				
1	Blower	15M3 / min	3	2	1
2	Water Jet Pump	25 m, 10M3 / h	2	1	1
3	Mobil Air Compressor	8 ber / 102 Psi	1	1	--

No.	Equipment	Main Specification	Workshop Class Ⅰ	Workshop Class Ⅱ	B T K P
4	High Pressure Water Jet	1000 ber	1	1*	--
* shows that it is planned only for Palembang, Jayapura, Pontianak and Merauke of DISNAV/ Sub DISNAV.					
E	HAND TOOLS				
1	Air Hammer	5 kg/cm2, 1500/min	2	1	--
2	Hand Pneumatic Chisel	5 kg/cm2, 1500/min	2	2	--
3	Hand Surface Chisel	0 150 mm, 3000 rpm	3	2	--
4	Hand Drilling	0-12 mm, 2600 rpm	3	2	1
5	Universal Hand Drill	0-25 mm, 250 rpm	2	1	1
6	Hand Circular Saw	0 270 mm, 3000rpm	2	1	1
7	Soldering	200 Watt	4	2	2
8	Hand Pneumatic Chipper	1/1,500 min, 1.2 cbm/min	2	1	--
9	Spray Gun For Painting	0.6 ltr, 130-200 l/min	2	2	1
10	Hand Hack Saw	Length 300 mm	4	3	1
11	Magnetic base for dial gauge		2	1	1
12	Hand Surface Grinder	350 - 500 Watt	2	1	1
13	Accu-Drilling Machine	1 - 10 mm , 9 - 12 V	2	1	1
F	BENCH TOOLS				
1	Parallel Vice	100 x 200 mm	3	2	2
2	Steel Anvil	313 x 416 mm	4	2	1
3	Hammer for Smith Set	2.7 kg, 5.0kg	4	2	1
4	Hammer Set	Claw & Test Hammer	2	1	1
5	Tracker	No.1 - 6	2	1	1
6	Petroleum Oil Torch		2	1	1
7	Slide Hammer Puller Set	No.1 - 6	2	1	1
8	Pipe Cutter Set	ö 10 - 90 mm	2	1	1
9	Pipe Wrench	10 - 40 & 40 - 90 mm	2	2	2
10	Chain Thong	19 - 100 & 38 - 200 mm	2	2	2
11	Die Set	8 - 50 mm	2	2	1
12	File Set For Machinist	L=150 , 200 , 250	3	2	2
13	Adjustable Wrench	20 - 60 mm	4	3	2
14	Reamer Set Taper Shank Type	10- 45 mm	3	2	2

No.	Equipment	Main Specification	Workshop Class Ⅰ	Workshop Class Ⅱ	B T K P
15	Wire Rope Cutter/Clamp Set	S/d 0 1,5 inc	2	1	1
16	Screw Driver Set	Complete set	4	2	2
17	Socket Wrench	8 - 27 mm	3	2	2
18	Caliper Outside & Inside Set	150,300 mm	4	2	2
19	Tool Box	Complete set	4	2	3
20	Steele Compass	150,300,400 mm	3	3	3
21	Spanner Adjustable	0 - 30 mm,0 - 50 mm	2	2	2
22	Bearing Scrapper	Approx 80 x 16	2	2	2
23	Ideal Pattern Snip	260 R, 260L	2	2	2
24	Mechanical Tool Box	Complete set	2	2	2
25	Torque Wrench Set	20 - 120& 40 - 200 Nm	2	2	2
26	Locker		12	8	8
27	Monkey Wrench		3	2	2
28	Filter Wrench		2	1	2
29	Bearing Puller Set	Complete set	2	2	2
30	Work Bench	basic model	2	2	2
31	Steel Pipe Vices	up to 90 mm	2	1	1
G	TESTING AND MEASURING EQUIPMENT				
1	Vernier Caliper	150,300,mm	4	2	2
2	Outside Micrometer	0 - 100 mm	2	1	2
3	Tubular Inside Micrometer	25 - 300 mm	2	1	2
4	Ruler Set	30 - 60 mm	2	2	2
5	Hand Tachometer Contact and Non Contact	50 - 20.000 rpm	2	2	2
6	Digital Multimeter	0 - 2 k,0 - 25k	3	2	2
7	Vibrometer	10 - 1000 Hz	2	1	1
8	Megger Tester		2	1	1
9	Digital Thickness Gage		2	1	2
10	Fuel Injection Tester	Pressure test	1	1	1
11	Gas Pressure Indicator		1	1	1
12	GPS Receiver		1	1	1
13	Luminous Intensity		1	1	1
14	Impedance Meter LCR		2	1	1
15	Dummy Load	10kW	1	1	1

No.	Equipment	Main Specification	Workshop Class Ⅰ	Workshop Class Ⅱ	B T K P
16	Multi Meter		2	1	1
17	Solar Module Test	0.5 V - 0.5 A	1	1	1
18	Battery Charger	DC 24 V 20A	1	1	1
19	Ultrasonic Thickness Gauge	0.5 - 500 mm	1	1	1
20	Thermometer Infrared		1	1	1
21	Digital Anemometer		1	1	1
22	Digital Barometer		1	1	1
23	Hair Hygrometer		1	1	1
24	Sound Level Meter		1	1	1
25	Digital Concrete Test Hammer		1	1	1
26	Tensile Strength Tester	5-1,000 kg	--	--	1
27	Impact Tester		--	--	1
28	Universal Testing M/C	10-200 ton	--	--	1
29	Earth Tester		1	1	1
30	PH Meter		1	1	1
31	Wet Film Thickness Gage		1	1	1
32	Ultrasonic Hardness Tester		1	1	1
H	ELECTRONIC EQUIPMENT				
1	Oscilloscope	min. 20MHz. 2-ch.	1	1	1
2	Voltmeter	300uV - 100V	1	1	1
3	Frequency Counter	10 Hz - 500 MHz	1	1	1
4	Regulated DC Power Supply	300V / 7A	1	1	1
5	Dipmeter (DIP Meter)	400 kHz - 200MHz	1	1	1
6	Function Power Meter	400 kHz - 200MHz	1	1	1
7	Digital Multimeter	1 M Ohm	3	2	2
8	Current Meter	250 A, DC/AC	1	1	1
9	Signal Generator	30 kHz - 40 MHz	1	1	1
10	TTL / CMOS Book		2	1	2
11	Electrician Tool Set	Complete set	4	2	2
12	EDM		1	1	1
13	Electronic Soldering Unit	150 – 450 deg C	4	3	3
14	Digital Clamp Meter AC/DC	up to 350A rasp. 750V	1	1	1
15	Insulation Tester	ACV and Ohm	1	1	1

No.	Equipment	Main Specification	Workshop Class Ⅰ	Workshop Class Ⅱ	B T K P
I	HANDLING EQUIPMENT				
1	Cain Hoist	1.5 Ton, 3 Ton	2	2	2
2	Electric Hoist	5 Ton	1	1	1
3	Overhead Traveling Crane	7.5 Ton	1	1	1
4	Fork Lift	7.5 Ton	2	1	1
5	Mobile Crane	10 Ton	1	-	--
6	Hydraulic Jack	30 Ton	2	2	1
7	Truck	7.5 Ton	1	1	--
8	Maintenance Car		1	1	1
9	Hydraulic Hand Pallet	2400 - 2600 kg	1	1	1
10	Traveling Unit Geared Trolley	min 5000 kg	1	1	--
11	Hydraulic Workshop Crane	900 - 1200 kg	1	1	--
J	GENERATOR SET ENGINE DIESEL				
1	Diesel Generator	55 kVA / 45 kVA	1	1	1
2	Mobile Generator	30 kVA	1	1	1

(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

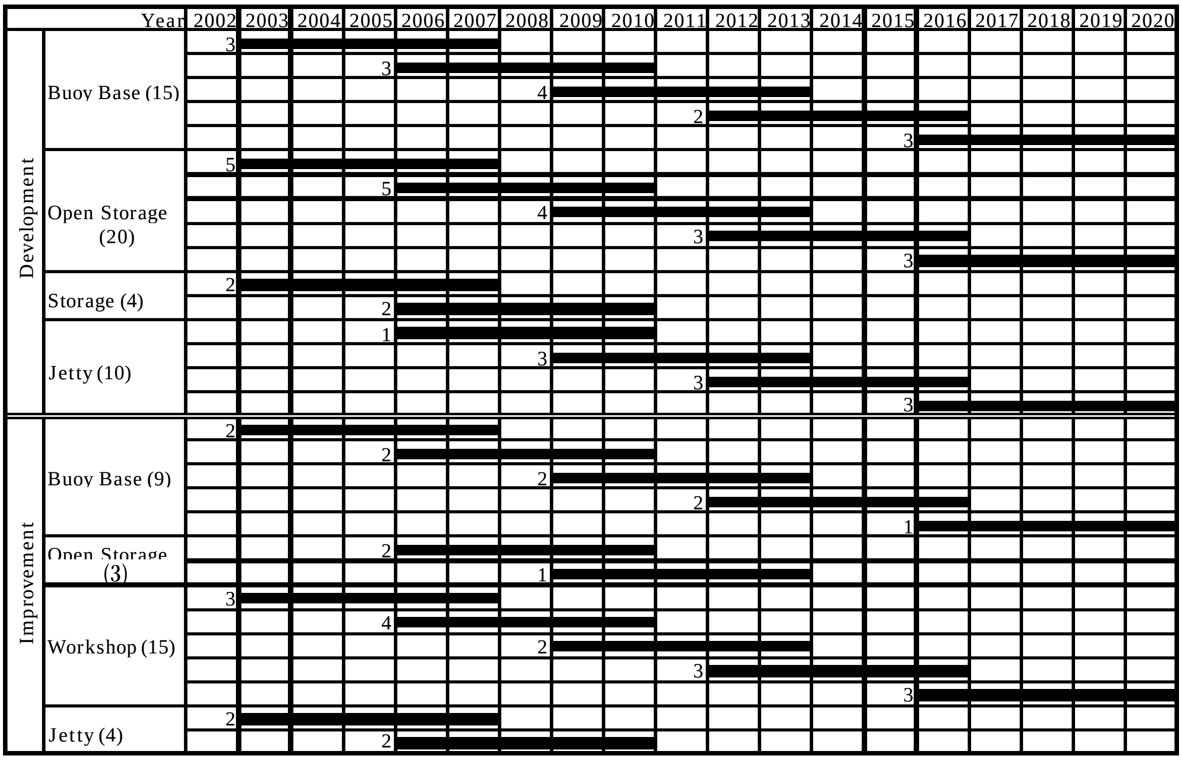
① DISNAV Dumai (Class I)
② DISNAV Palembang (Class II)
③ Sub DISNAV Cilacap (Class II)
④ DISNAV Samarinda (Class I)

Further study must be required for jetty prior to commencement of the project.

1.3.3.3. Implementation Schedule and Cost Estimation for Buoy Base and Workshop

Implementation schedule for workshops and buoy bases etc. are shown in **Table 1.3.15.**

Table 1.3.15. Implementation Schedule for Supporting Facilities (Buoy Bases and Workshops)



Estimated project cost for development and improvement of workshops and buoy bases except jetty is shown in **Table 1.3.16.**

Table 1.3.16. Estimated Cost 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

1.4. VTS System

1.4.1. General

In June 1998, the IMO approved three (3) sea lanes for Indonesia. As a result, vessels navigating sea lanes are given right of innocent passage of Indonesian territorial waters. Responsibilities given to vessels and GOI are as follows:

- Vessels navigating inside a sea lane shall not deviate more than 25 nautical miles from axis line of the sea lane.
- Formulation of safety measures for sea lane such as lighthouse, light beacon and others by GOI.
- Formulation of surveillance system for vessels navigating inside sea lane in accordance with UNCLOS 53 by GOI.

Master Plan for VTS System is required to formulate for Malacca/Singapore Strait, Sea Lane Ⅰ,Ⅱand Ⅲ for surveillance of vessels navigating sea lanes and relative sea area. To formulate VTS System in Master Plan, the following items 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 andⅡissued by French Consultant Group.
- German Loan Project.

1.4.2. Review of Present Status

(1) General

Three (3) sea lanes are designated in Indonesian waters as follows:

Sea Lane Ⅰ: Sunda Strait, Jawa Sea, Kalimata Strait heading to South China Sea,

Sea Lane Ⅱ: Lombok Strait, Makassar Straits, heading to Celebes Sea,

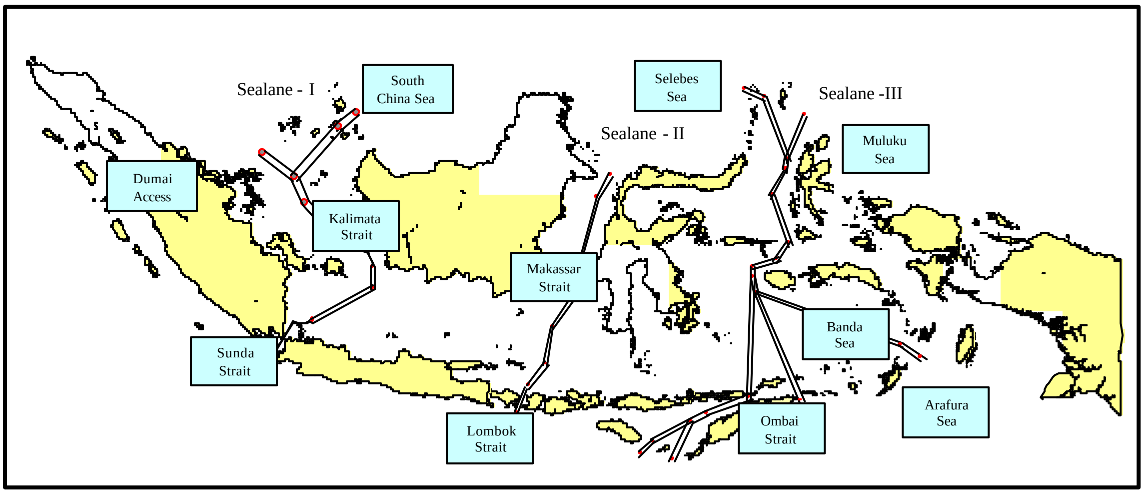
Sea Lane Ⅲ: Indian Ocean, Arafura Sea, Banda Sea, Maluku Sea heading to Pacific Ocean and Celebes Sea.

Malacca/Singapore Straits:

In accordance with regulation V/8-1 of the 1974 SOLAS Convention, Indonesia, Malaysia and Singapore proposed to formulate a Mandatory Ship Reporting System in the Strait of Malacca and Singapore Strait as known as STRAITREP. To attain the objectives of STRAITREP, twelve (12) radar stations were formulated. As of December 2001, STRAITREP has been in service for Malacca and Singapore Straits. Ship navigating report is now sending to Indonesia from Singapore by E-mail. On the other hand, the formulation of additional radar station by Indonesia for Malacca and Singapore Strait might cause technical problem for the existing radar system.

As a result of this, we focused our study to Sea Lane I, Sea Lane II and Sea Lane III and Access route to Dumai and Surabaya. Sea lanes and related waters to be studied are proposed as shown in **Figure 1.4.2.(1)**.

Figure 1.4.2.(1) Sea lanes and Related Sea Waters



The objectives of formulation of VTS system are:

- Ensuring a navigation safety for all vessels navigating inside the sea lanes and relative sea areas.
- Managing navigation of all vessels that must sail inside sea lanes with the normal speed.

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To attain the foresaid objectives, the following system and equipment are required.

- Aids to Navigation
- VTS System
- Patrol boats
- Airplane, Helicopter
- Others

German Project formulated Aids to Navigation such as Lighthouse, Light beacon, Racon and Buoys along Sea Lane I, II and III The additional Aids to Navigation for Sea Lanes I, II and III are proposed in other sections of this report to attain safety inside sea lanes.

Patrol boats, Airplanes, Helicopter and others are out of scope of this study. When VTS System has been completed, this system will assist DGSC to achieve the following objectives:

- Informing the vessels navigating in sea lane about sea lane regulation, information for safety navigation, traffic density, and special hazard in sea lanes, weather information and others if any.
- Performing real time traffic survey of vessels navigating sea lanes.
- Grasping data to formulate Traffic Separation Scheme (TSS).

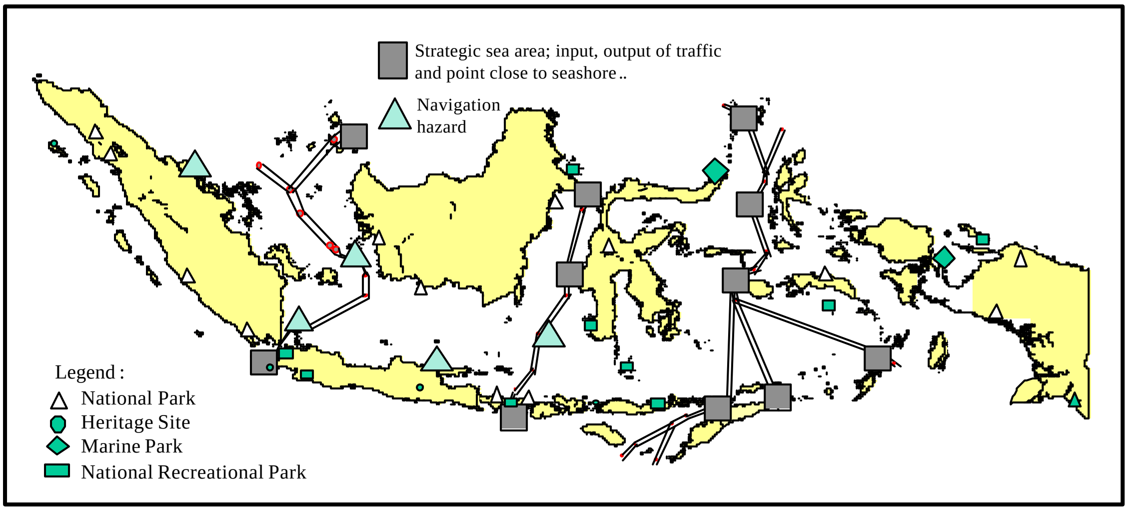
(2) Review of Present circumstance.

To select the project site for VTS System, the following aspects should be considered.

- Strategic aspect.
- Navigational hazards.
- Environmental condition.
- Traffic density and patterns.
- Relation with Existing VTMS for Malacca / Singapore Strait.
- Application schedule of AIS.
- Marine casualty related with sea lanes.

The potential project sites are shown in **Figure 1.4.2.(2)**.

Figure 1.4.2.(2) Potential Project Sites



Present status of each potential project sites are studied as follows:

① Strategic aspect

Both ends of sea-lanes are important area for surveillance of in/out vessels that may be navigating inside sea lane, so that those seawater areas are proposed as strategic areas. Detailed seawater areas are proposed as follows:

- Sunda Strait and Natuna Island seawater area for Sea Lane Ⅰ
- Lombok Strait and North Makassar Strait for Sea Lane Ⅱ
- Ombai Strait, Romang Strait, Entrance of Banda Sea area
- Pulau Maru sea area and Pulau Mayu for entrance of Sea lane Ⅲ
- Pulau Romang and Pulau Molu for entrance of Sea lane Ⅲ

And also, for surveillance of the navigating vessels close to the seashore, the proposed sea areas are as follows:

- Central Makassar area
- Pulau Sulabes

② Navigational hazards

The following waters has hazard for navigation, and details are described in aspect of navigational hazard as follows:

- Sunda Strait: Northwest side of Pulau Seribu. There are many Oil fields. Sea lane is surrounded both side by Oil fields.
- Kalimata strait: This part of sea-lane has only 4 miles wide and is surrounded both side by numerous reefs.
- South Makassar: This part of sea-lane is located at West side of Pulau Kalukalukung and surrounded both side by reefs.
- Dumai access: Access navigation route from Malacca strait for Dumai port is complicate, narrow and near to seashore.
- Surabaya access: Access route is complicate and narrow.

③ Environmental condition

Areas such as National park, National Recreation Park, Marine park and Heritage area are located beside of sea lanes. Those are considered to be protected from spoil caused by marine accident. Those areas are shown in **Figure 1.4.2.(2)**.

④ Present status of Traffic in Sea Lane Ⅰ, Ⅱ, Ⅲ and Dumai/Surabaya Access

- Present traffic density should be considered to select sea area for VTS system. Present traffic is shown in the following tables for each waters.

Table 1.4.2.(1) Traffic Data of Through-traffic for Malacca/Singapore Strait

Type of vessel	Total number of vessel per year	Average number of vessels per day	Remarks
Tanker, Cargo Boat, Containers, Fishing Boat, Ferry Boat and Others	55,957	307	
Total	55,957	307	

Note) Small size of fishing boats and ferryboat are not accumulated in this table.

Source: Survey report of JICA Study Team.

Table 1.4.2.(2) Vessels Navigating in Sunda Strait Area including Ferry Crossing Strait

Type of vessel	Total number of vessel per year	Average number of vessels per day	Remarks
Tanker, Cargo Boat, Containers, Fishing Boat, Ferry Boat and Others	20,440	56	Ferry categorized in this column is navigating inside sea lane.
Ferry crossing sea lane	57,305	157	
Total	77,745	213	

Note) Source: Survey report of JICA Study Team.

Table 1.4.2.(3) Vessels Navigating in Lombok Strait Area including Ferry Crossing Strait

Type of vessel	Total number of vessel per year	Average number of vessels per day	Remarks
Tanker, Cargo Boat, Containers, Fishing Boat, Ferry Boat and Others	6570	18	Ferry categorized in this column is navigating inside sea lane.
Ferry crossing sea lane	15,695	43	
Total	22,265	61	

Note) Source: Survey report of JICA Study Team.

Table 1.4.2.(4) Numbers of Vessels of Through-traffic Passed from Moluca Sea to Celebes Sea for Sea Lane III

Type of vessel	Total number of vessel per year	Average number of vessels per day	Remarks
Tanker, Cargo Boat, Containers, Fishing Boat	2,373	6.5	
Tanker, Bulker, Cargo boat, LNG Carrier	292	0.8	
Total	2,665	7.3	

Note) Source: Survey report of JICA Study Team.

Table 1.4.2.(5) Traffics Passing Access Route for Dumai Port

Type of vessel	Total number of vessel per year	Average number of vessels per day	Remarks
Cargo and Passenger ship	6,855	38	Dumai is famous as Oil forwarding port.
Total	6,855	38	

Source: "Statistik Perhubungan 1998"

Table 1.4.2.(6) Traffics Passing Access Route for Surabaya Port

Type of vessel	Total number of vessel per year	Average number of vessels per day	Remarks
Cargo and Passenger ship	21,027	115	
Total	21,027	115	

Note)

a. Data is the sum of Gresik and Tg. Perak.

b. Source: "Statistik Perhubungan 1998"

⑤ Existing VMTS for Malaysia / Singapore Strait

The VTMS system has been formulated in 1998 to control vessels navigating inside Malacca/Singapore strait. Malaysia/Singapore strait is divided into ten (10) sectors that are covered by the radars and VHF radio communication system. This system was formulated and operated by Malaysia/Singapore upon agreement among three countries (Indonesia, Malaysia and Singapore). The twelve (12) radar sites are installed at the locations shown in **Figure 1.4.2.(3)**. The access route to Dumai port is not covered by Malacca/Singapore VTMS system. Detailed name and locations of radar sites for Malacca/Singapore VTMS is shown in **Table 1.4.2.(7)**.

Figure 1.4.2.(3) Location Map of Radar Sites of Existing VTMS System

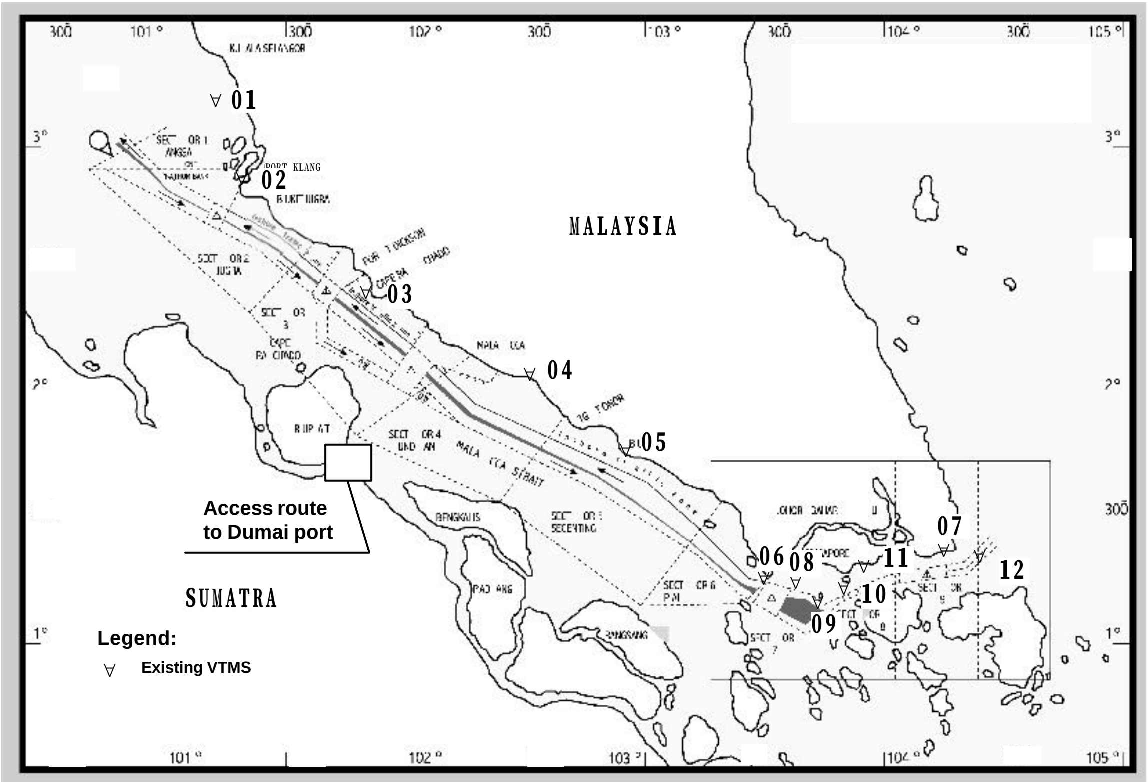


Table 1.4.2.(7) Location of Radar Sites for Existing VTMS System

ID	Station Name	Location		Nation
		Latitude	Longitude	
01	Pulau Angsa	3,11,10N	101,13,19E	Malaysia
02	Bukit Jugra	2,52,00N	101,19,59E	Malaysia
03	Cape Rachado	2,24,24N	101,51,11E	Malaysia
04	Pulau Undan	2,04,59,N	102,31,59E	Malaysia
05	Bukit Segenting	1,46,28N	102,55,55E	Malaysia
06	Tanjung Piai	1,15,30N	103,30,43E	Malaysia
07	Bukit Pengerang	1,46,29N	102,55,55E	Malaysia
08	Sultan Shoal Lighthouse	1,14,24N	103,39,02E	Singapore
09	Raffes Lighthouse	1,09,30N	103,44,31E	Singapore
10	St. John's Lighthouse	1,12,49N	103,51,07E	Singapore
11	Bedok	1,18,30N	103,56,06E	Singapore
12	Horsburgh Lighthouse	1,19,58N	104,24.2.5E	Singapore

⑥ Application schedule of AIS

IMO has adopted the revision of SOLAS Chapter V at the 73rd session of Maritime Safety Committee in December 2000 and AIS becomes a mandatory equipment to be installed on SOLAS Convention ships after July 1, 2002 according to the schedule indicated in **Table1.4.2.(9)**

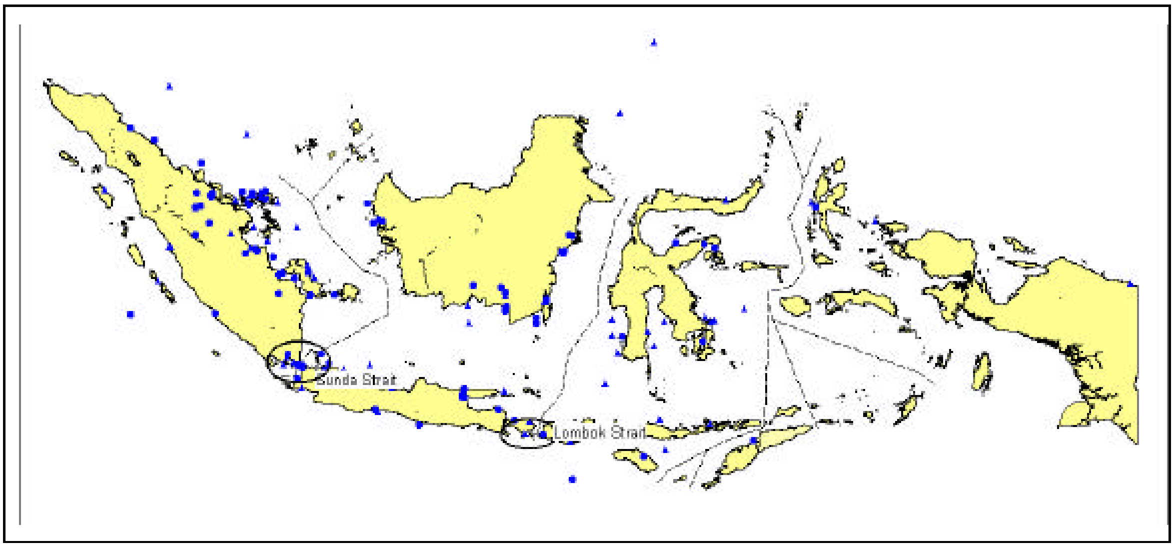
However, there is no obligation to install AIS on non-SOLAS ships.

If AIS information is introduced to VTS operation, it will be of very useful for surveillance. Furthermore, long-range AIS application using long-range communication system may be examined.

⑦ Marine Casualties related with sea-lanes.

Marine casualties related with sea-lane are shown in **Figure 1.4.2.(4)** Marine casualties are observed in waters of Sunda Strait and Lombok Strait.

Figure 1.4.2.(4) Marine Casualties Related with Sea lane



Note) This shows casualties of Collision and Aground only.

Detailed data of casualties in Sunda and Lombok Strait is summarized in **Table 1.4.2.(8)** from year 1993 to 2000 as follows:

Table 1.4.2.(8) Summarized Data of Casualties in Sunda and Lombok Strait

Name of Strait	Kind of casualty	Frequency	Victim
Sunda	Collision	2	3 persons injured.
	Aground	3	None
	Sunken	2	None
Lombok	Sunken	2	14 persons died

Table 1.4.2.(9) The Detailed Application Schedule of AIS for Vessels

Ship's type		Construction		Installation Deadlines							
		Before July 1. 2002	On or After July 1. 2002	Construction Date	1-Jul-03	First Survey after July 1, 2003	1-Jul-04	1-Jul-05	1-Jul-06	1-Jul-07	1-Jul-08
International Voyages	All Passenger Ships Ships of 300gt and upwards										
	All Passenger Ships										
	Tankers of 300gt and upwards										
	Ships of 50,000gt and upwards (Excludes passenger ships & tankers)										
	Ships of 10,000gt and upwards but less than 50,000gt (Excludes passenger ships & tankers)										
	Ships of 3,000gt and upwards but less than 10,000gt(Excludes passenger ships & tankers)										
	Ships of 300gt and upwards but less than 3,000gt(Excludes passenger ships & tankers)										
Non International Voyages	All passenger ships Ships of 500gt and upwards										

1.4.3. Proposed Sites for Master Plan

(1) General

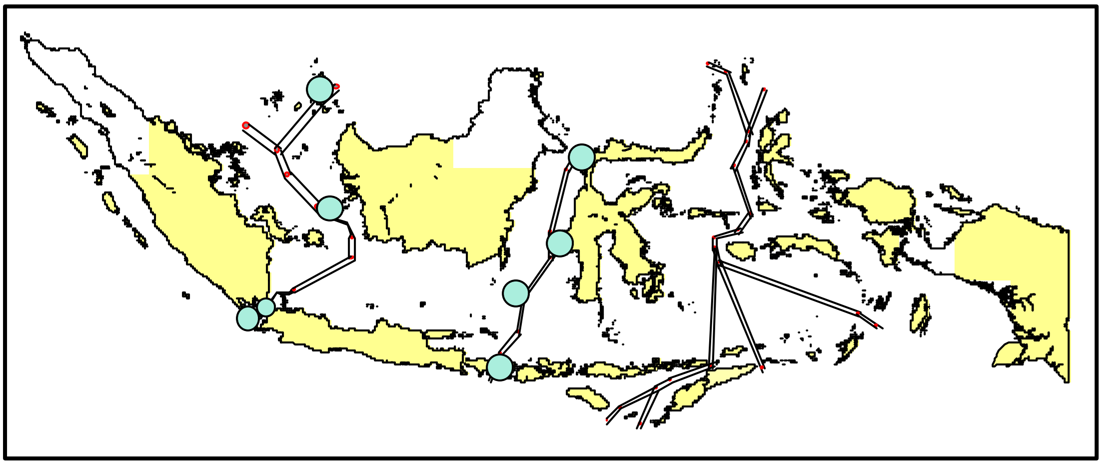
To select the project sites for Master Plan by year 2020, the present status related three (3) sea-lanes and other seawater areas are reviewed in previous clauses.

To formulate VTS System, we must decide project sites for Remote station sites and Main/Sub Center sites. Remote station equipment such as radar and/or AIS are installed at Remote station site and the center equipment such as data processor, display and console is installed at Main/Sub Center.

(2) Project sites for remote site

French Consultant Group proposed eight (8) radar sites as remote station site for VTMS along Sea Lane Ⅰ & Ⅱ in the “Feasibility Study” submitted to DGSC in June 1998. One Main Center is proposed to formulate at Jakarta in Jawa Island.

Figure 1.4.3.(1) Project Sites Proposed by French Consultant Group for Sea Lane Ⅰ and Sea Lane Ⅱ



This allocation plan is adopted basically for Master Plan by year 2020. In addition, six (6) VTS remote sites are proposed for Sea Lane Ⅲ as remote site and two (2) VTS System for Access route areas to Dumai and Surabaya port based on review of present status.

The remote sites are selected in accordance with the criteria shown as **Table 1.4.3.(1)**. The selected remote sites are shown in **Table 1.4.3.(2)**. This allocation plans for remote station site is shown in **Figure 1.4.3. (2)**.

Table 1.4.3.(1) Criteria for Selection of Remote Sites

Item No.	Criteria
(1)	Entrance or Exit for sea lane to manage vessels navigating in sea lanes.
(2)	Dangerous sea-area of navigation route where is surrounding by reef or sea lane is passed near of seashore.
(3)	Sea area where marine resort / leisure is located.
(4)	Traffic congested area where sea lane and ferry route is crossed.
(5)	Sea area where marine casualty occurred frequently.

It is obvious that surveillance of whole area of sea lanes is impossible by those radar stations and other survey measures to complement might be looking for. As the width of sea-lane is wide except some part of sea lane, it will not need to have a strict rule for safe navigation and survey traffic status in whole sea-lane continuously.

Figure 1.4.3.(2) Project Site for Remote Station Sites

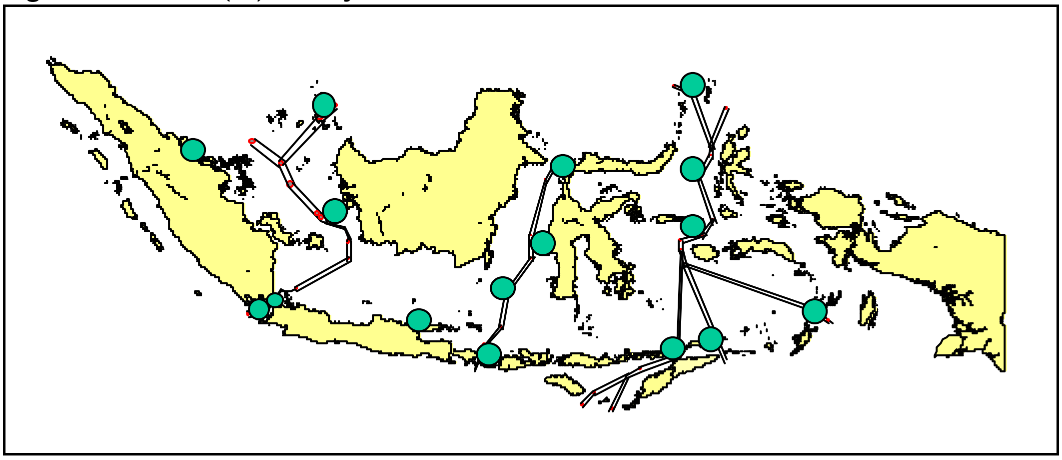


Table 1.4.3.(2) List of Project Sites (Remote Site s)

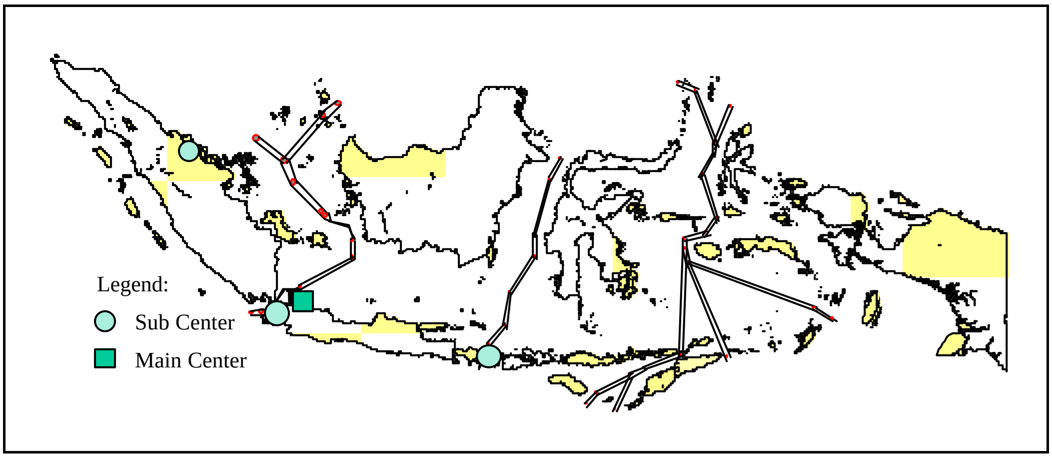
Site ID	Name of Project site	Related Sea area	Related Sea lane	Items to considered				
				Strategic aspect	Navigational hazard	Environ- mental Condition	Traffic density and pattern	Marine casualties
01	Dumai access	Malacca Singapore Strait	-		◎		◎	
02	Surabaya access	Java Sea	-		◎		◎	
11	Tanjung Lesung	Sunda Strait Area	I	◎		◎		
12	Merak	Sunda Strait Area	I			◎	◎	◎
13	Sarutu Island	Kalimata Strait Area	I		◎			
14	Natuna Island	Natuna Area	I	◎				
21	Tanglad	Lombok Strait Area	II	◎			◎	◎
22	Kalukalukuang Island	South Makassar Area	II		◎			
23	Buttu Tuopoang	Central Makassar Area	II		◎			
24	Buttu Salome	North Makassar Area	II	◎				
31	Alor island	Lombok strait	III	◎				
32	Pulau Romang	Romang Strait Area	III	◎				
33	Molu Island	Banda Sea Area	III	◎				
34	Sulabes Island	Banda sea Area	III		◎			
35	Mayu Island	Moluca Sea Area	III	◎				
36	Maru Island	Pulau Maru Sea Area	III	◎				

(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.

The Main Center system having operation console is installed at Jakarta. Center can monitor vessels navigating sea lane and communicate with vessels by VHF radio system from Jakarta except Sunda Strait area, Lombok Strait area, Dumai access area and Surabaya access area. The Sub Center is formulated at Sunda Strait area, Lombok Strait area, Dumai access area and Surabaya access area to manage vessels navigating respective strait and sea area. Sunda and Lombok Sub Center has role as a training center for VTS operators and as a supporting center for formulation of regulation related to sea lane management. Allocation plan of Main and Sub Center sites are shown **Figure 1.4.3.(3)**.

Figure 1.4.3.(3) Project Site for Main and Sub Center



1.4.4. 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 1.4.4** 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 1.4.4. 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	Jawa Timur	2	20	22	16
11	Tanjung Lesung	Jawa Barat	130	35	165	34
12	Merak	Jawa 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.

(1) VTS System for Sealane area

Service area of radar and/or AIS for Sealane 1～3 are shown in **Figure 1.4.4.(1), Figure 1.4.4.(2), Figure 1.4.4.(3), Figure 1.4.4.(4), Figure 1.4.4.(5)** and **Figure 1.4.4.(6)**.

Figure 1.4.4 .(1) Service Area of Radar/AIS for Sea Lane Ⅰ

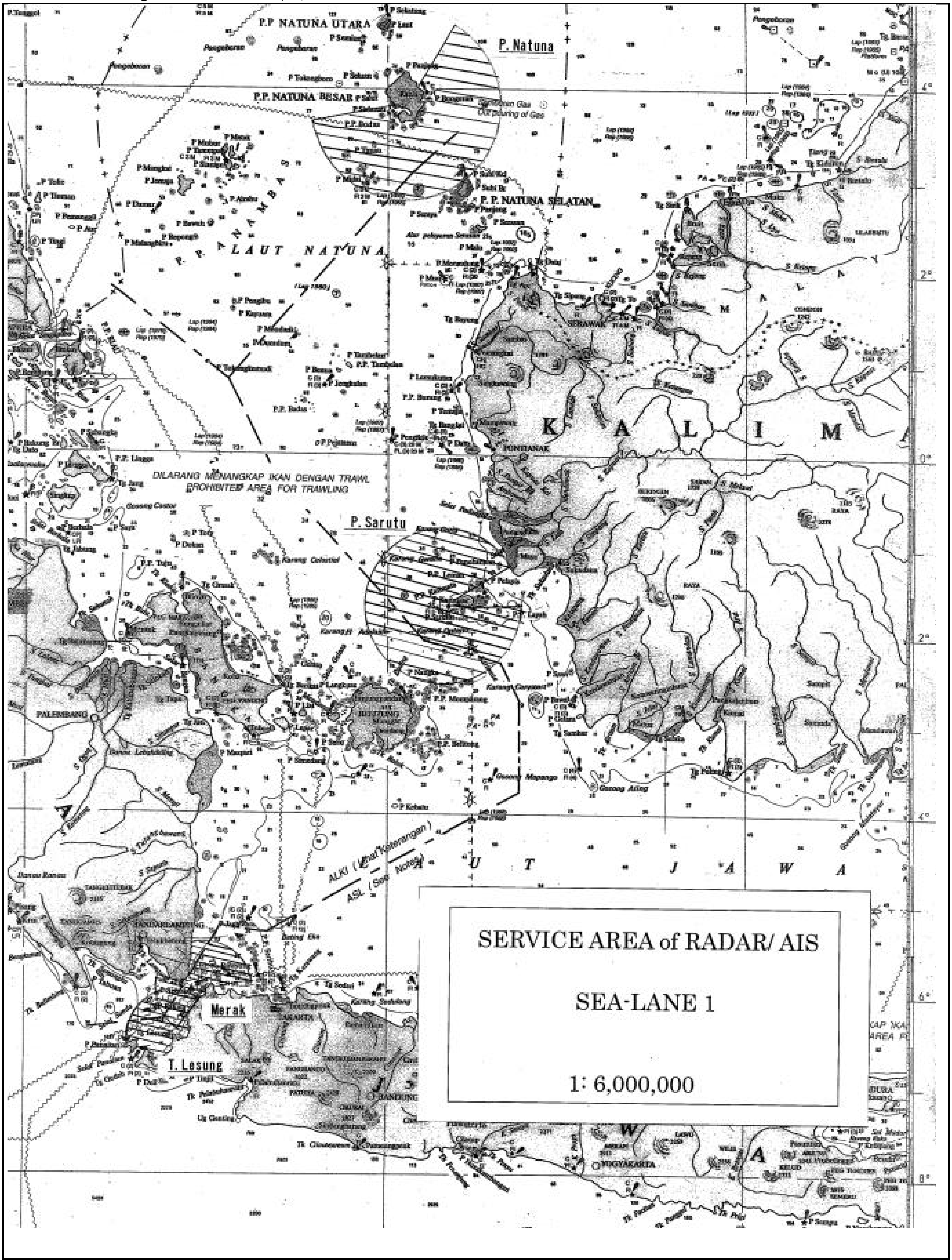


Figure 1.4.4 .(2) Service Area of Radar/AIS for Sea Lane Ⅱ

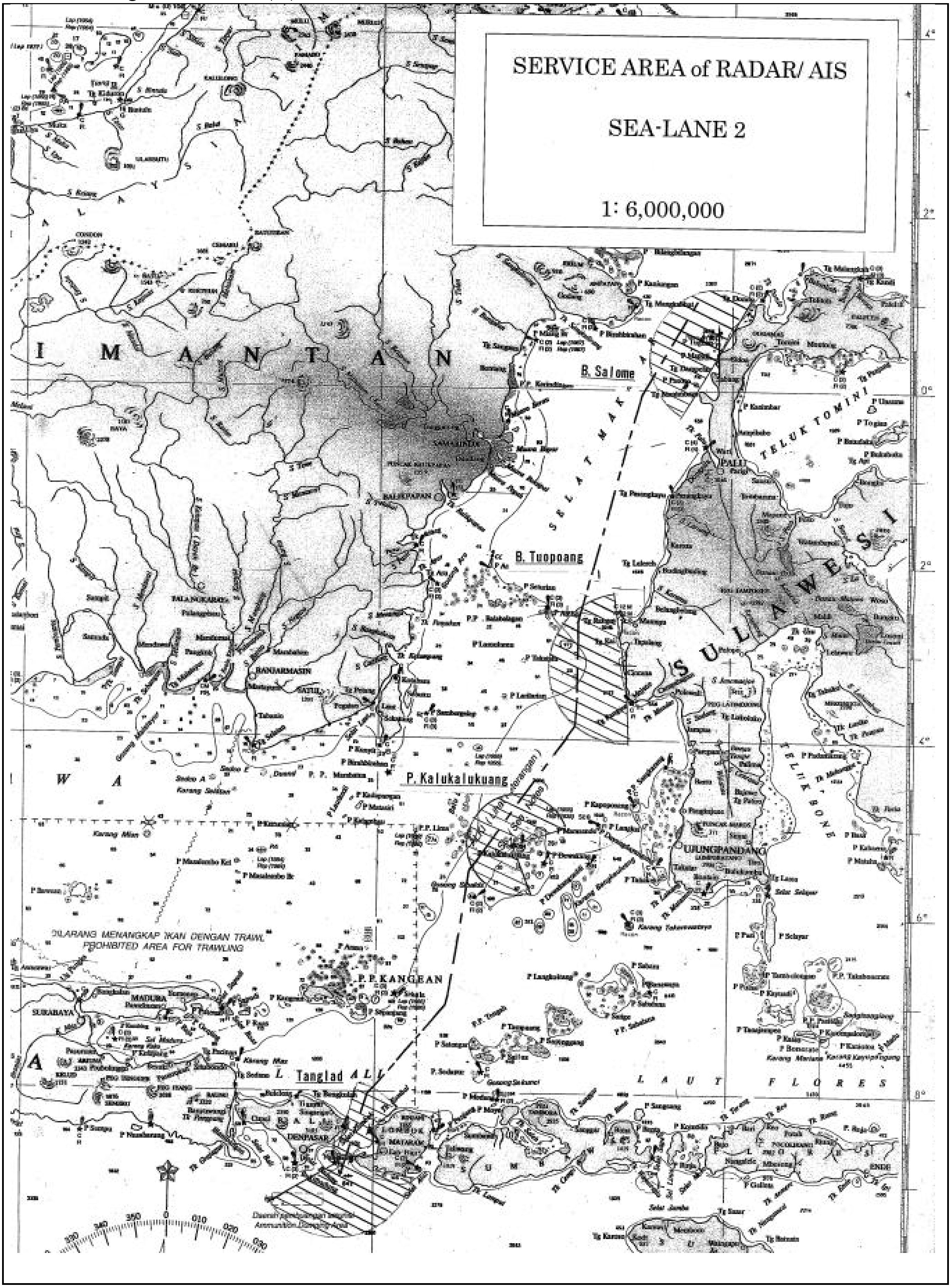
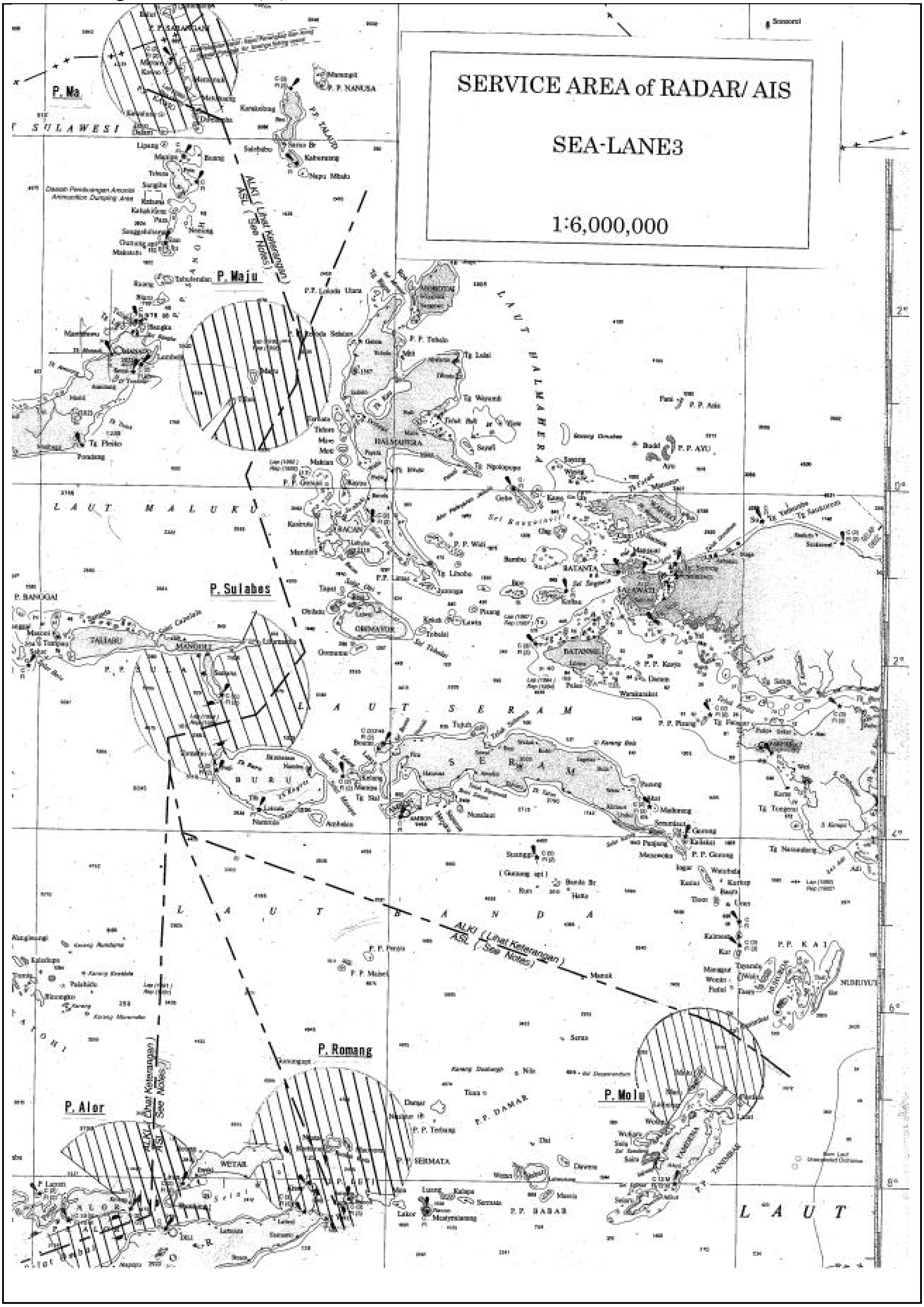


Figure 1.4.4 .(3) Service Area of Radar/AIS for Sea Lane Ⅲ



(2) VTS System for Dumai and Surabaya access route

In Dumai and Surabaya access route, route channel is very long and narrow. Moreover, route path in Dumai is bent sharply along with the undersea not shallow part of the channel. So that, extra care is to be taken there in maneuvering ship by captain.

If captains can easily get such information that the ship is coming from counter direction or the ship is altering her course or not, encountering ship’s captain would be free from his mental burden.

By this reason the installation of VTS systems in this district should be taken in consideration.

Two (2) radar stations are necessary in Dumai VTS System, and three (3) radar stations in Surabaya VTS System. Because the route way is bent sharply, multiple numbers of radar station are necessary. This number of radar stations does not contain the port VTS radar station that is used for the detection for ships that are berthing in the port.

For this purpose, short range but high resolution radar is necessary. Therefore, antenna height, 25 m is enough for Dumai system and radar range 20km will be obtained. The same condition is also good for Surabaya system.

Figure 1.4.4 .(4) Service Area (Dumai Access)

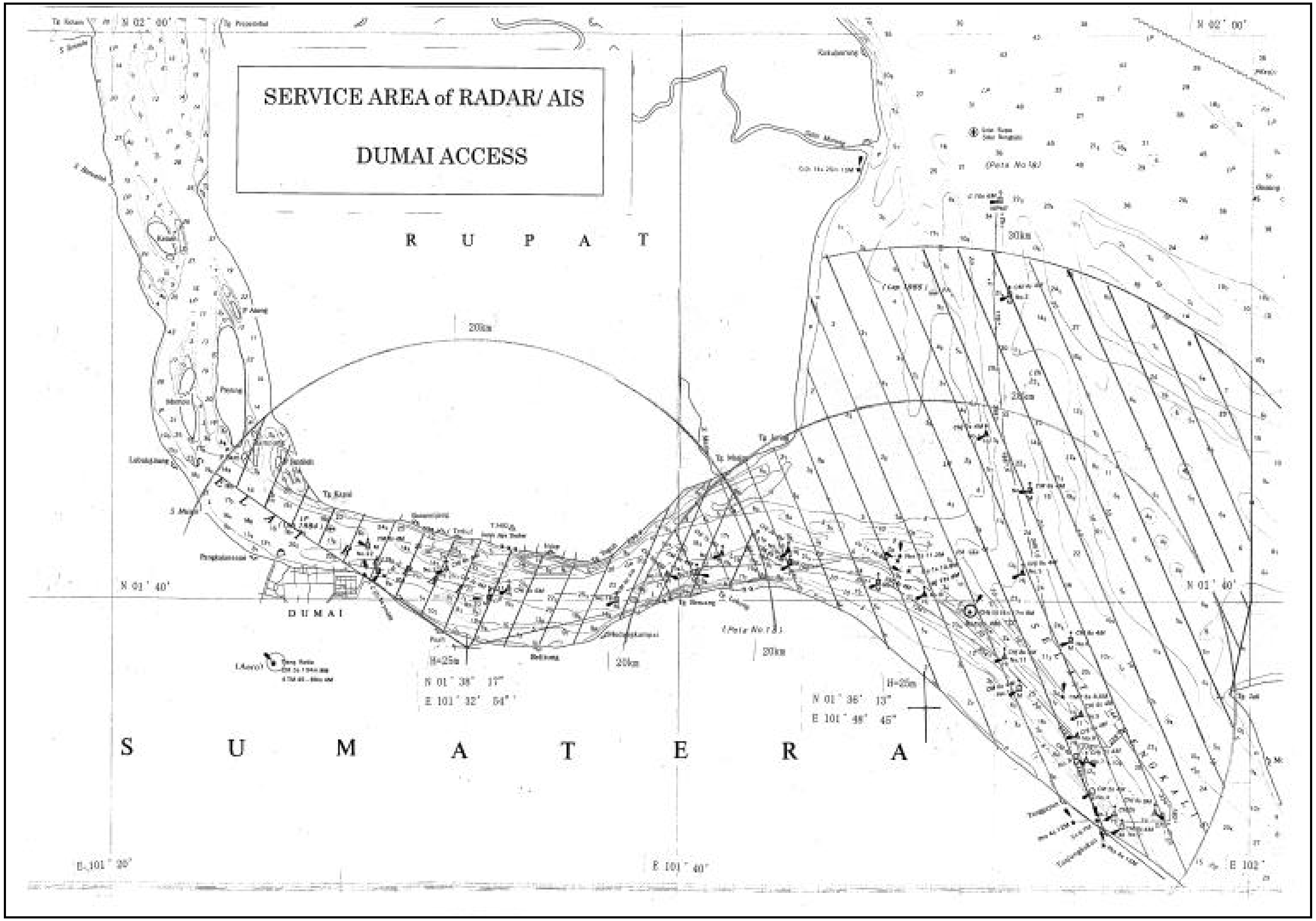


Figure 1.4.4 .(5) Service Area (Surabaya Access -1)

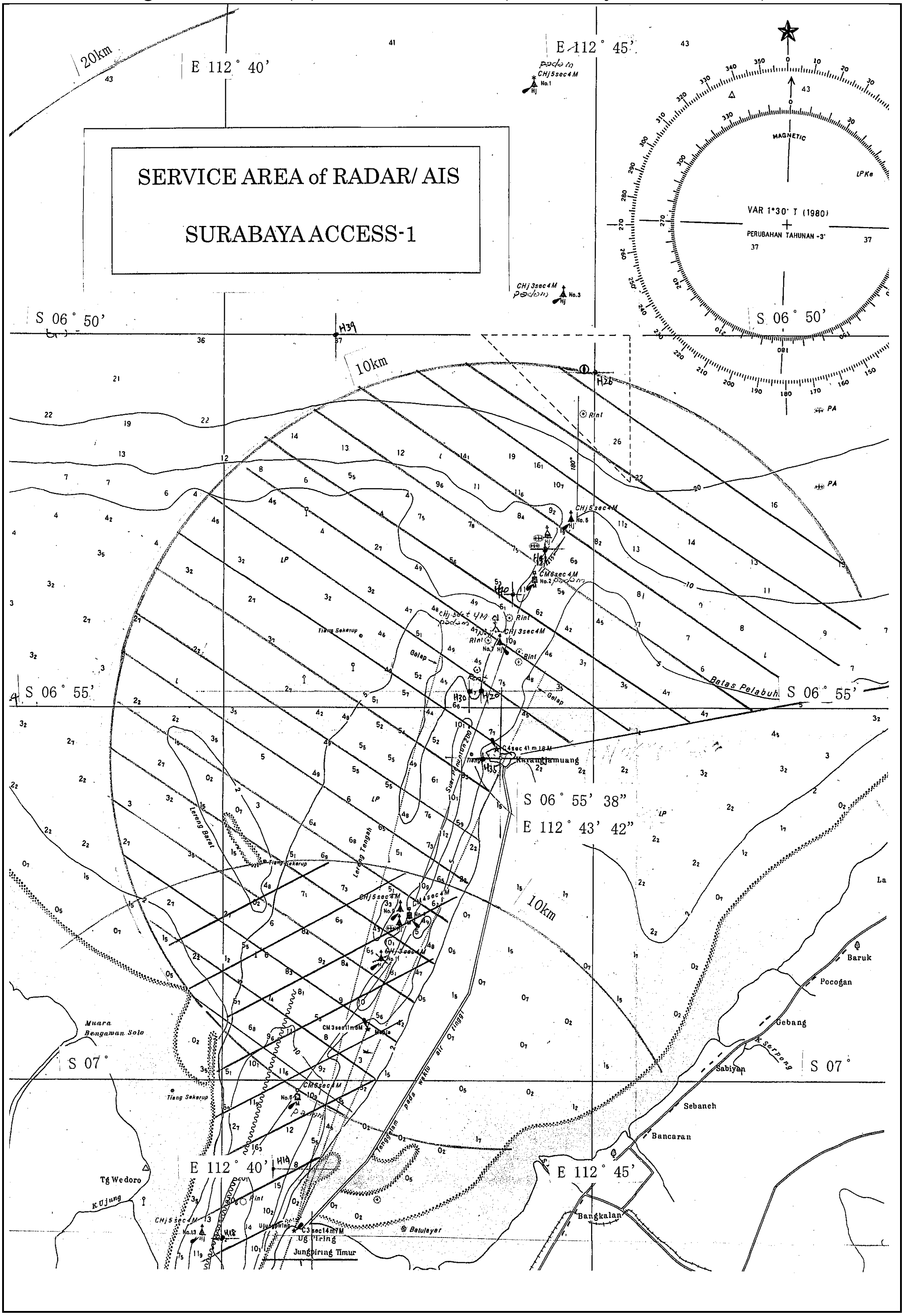
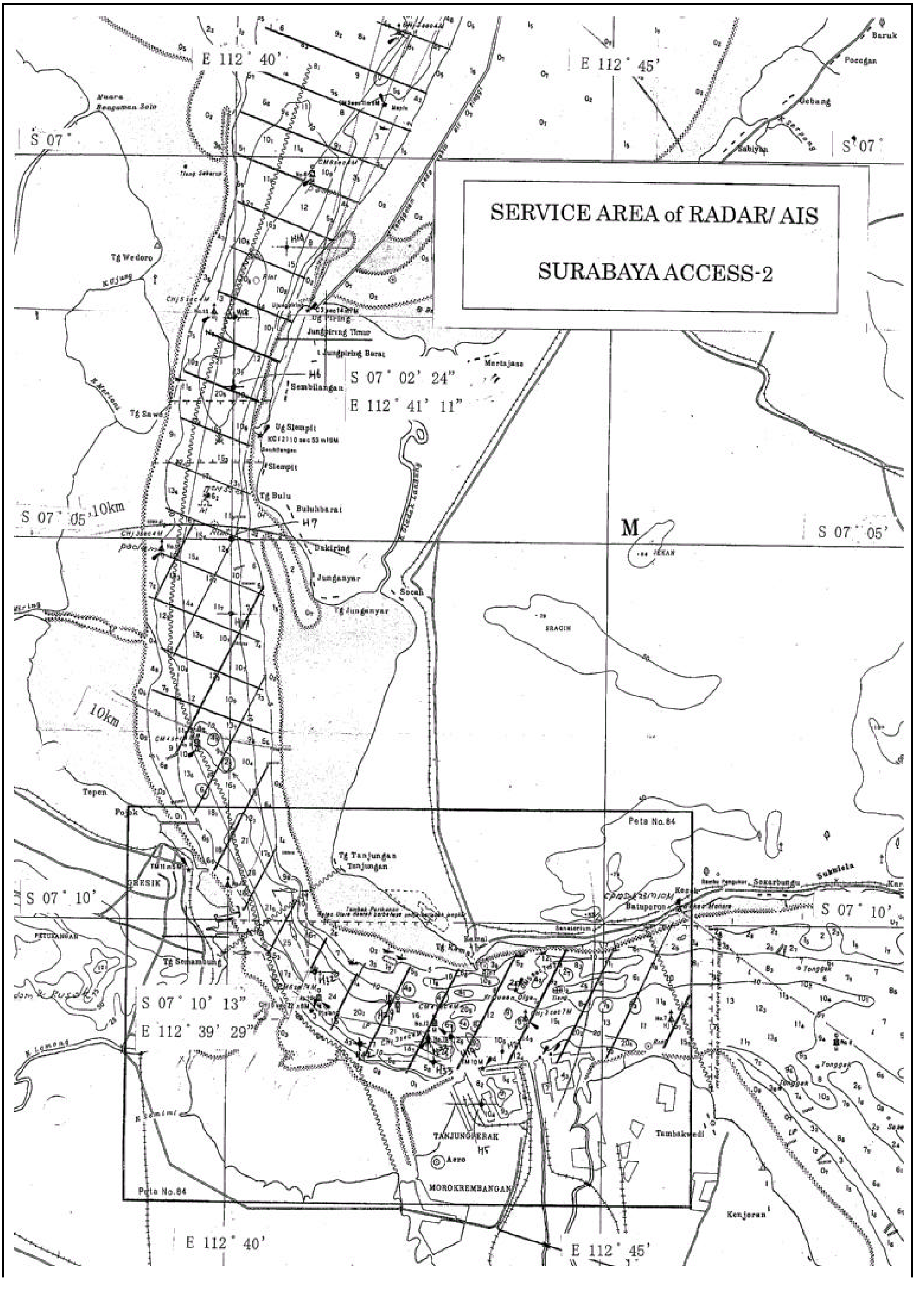


Figure 1.4.4 .(6) Service Area (Surabaya Access -2)



1.4.5. System Design

(1) General

The typical configuration of VTS System is shown in **Figure 1.4.5.(1)**, **Figure 1.4.5.(2)**, **Figure 1.4.5.(3)** and **Figure 1.4.5.(4)** Typical system configuration – 1 and 2 are shown in case radar and AIS are adopted as sensor. Typical system configuration – 3 and 4 are shown in case only AIS is adopted as sensor.

Figure 1.4.5.(1) Typical System Configuration-1 (In Case Sub Center and Repeater Station are Adopted)

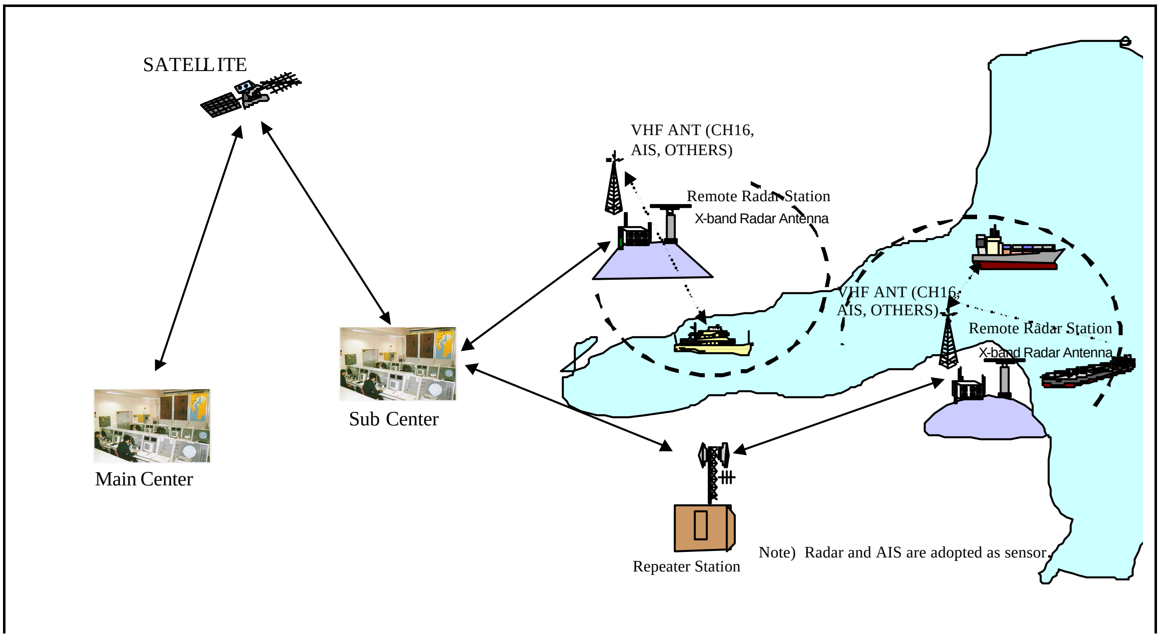


Figure 1.4.5.(2) Typical System Configuration-2

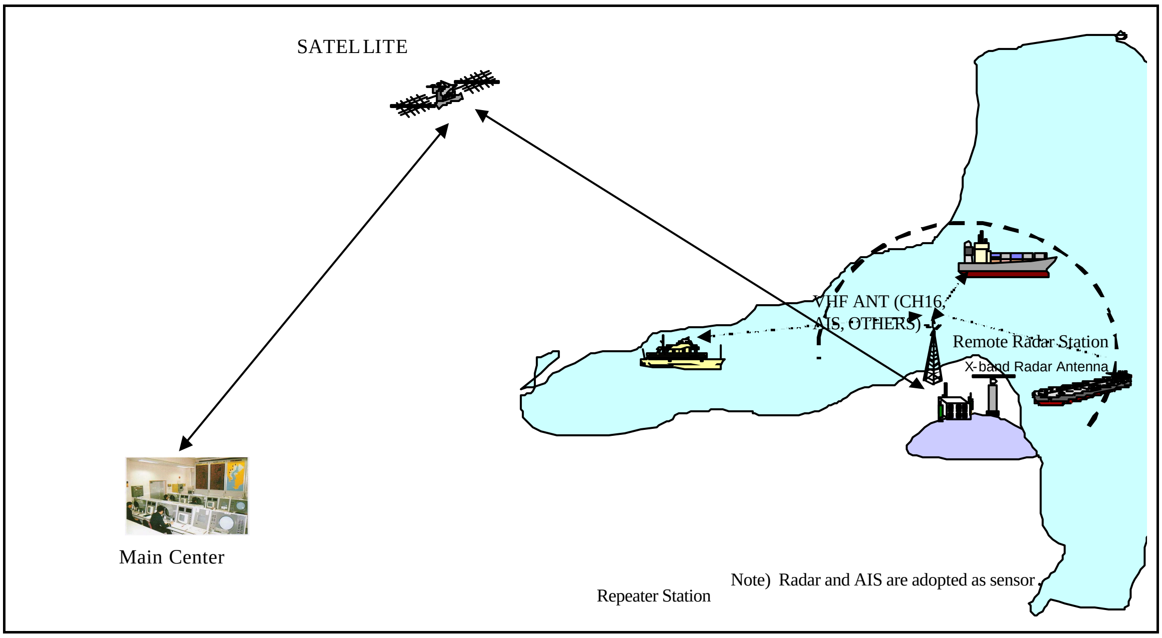


Figure 1.4.5.(3) Typical System Configuration-3
(In Case Sub Center and Repeater Station are Adopted)

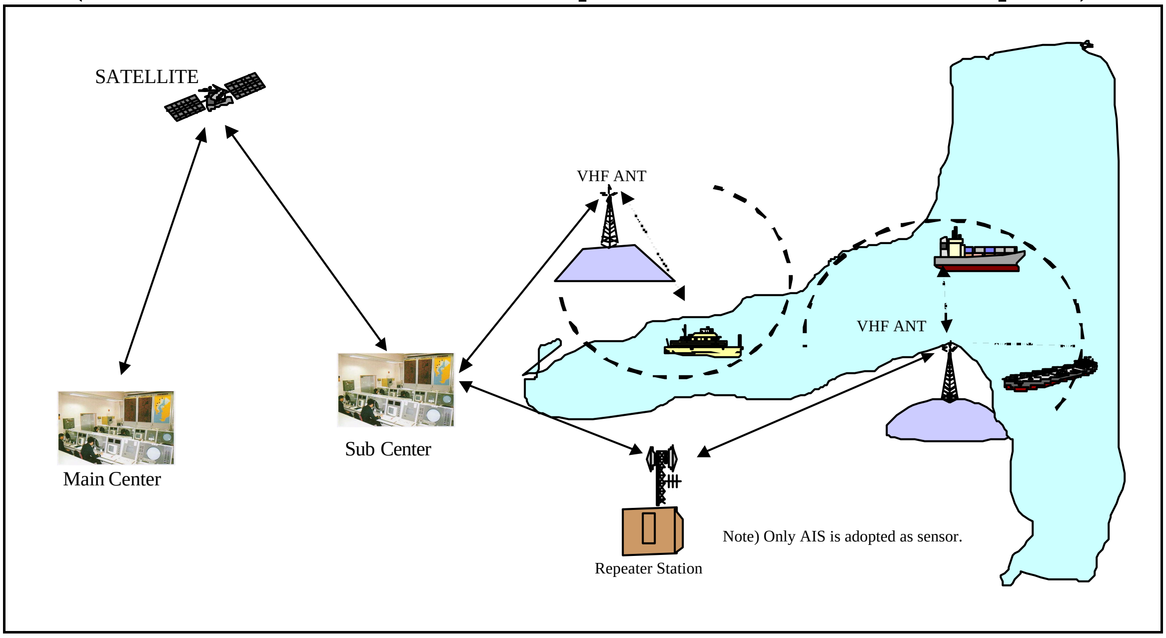
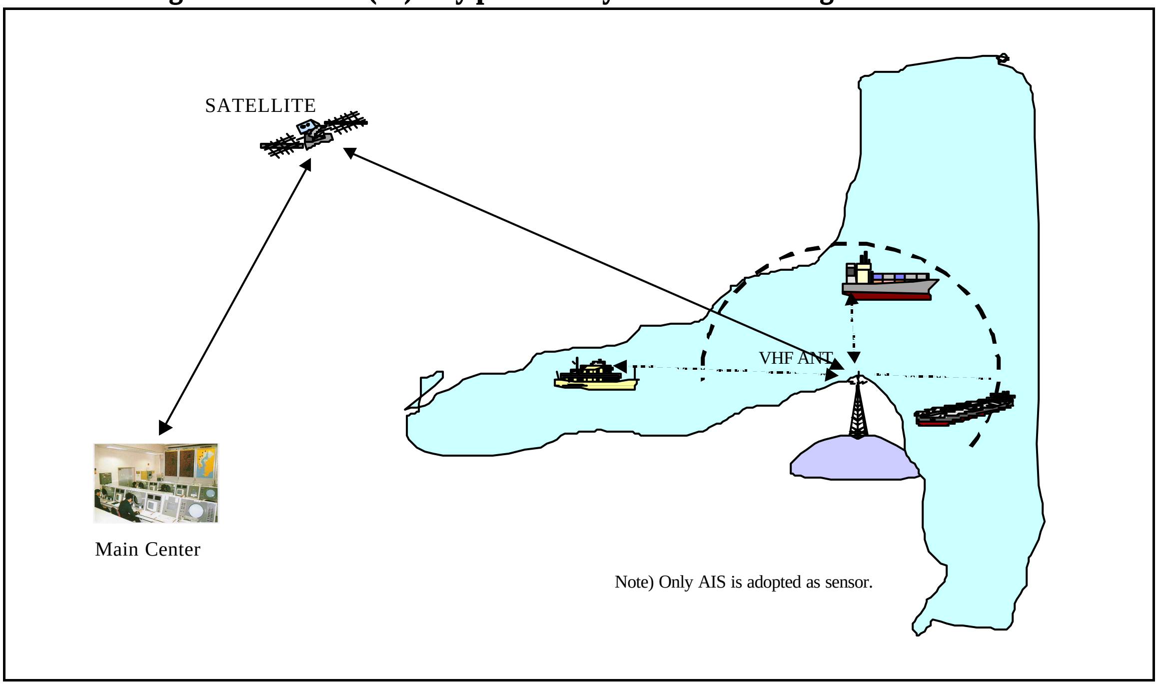
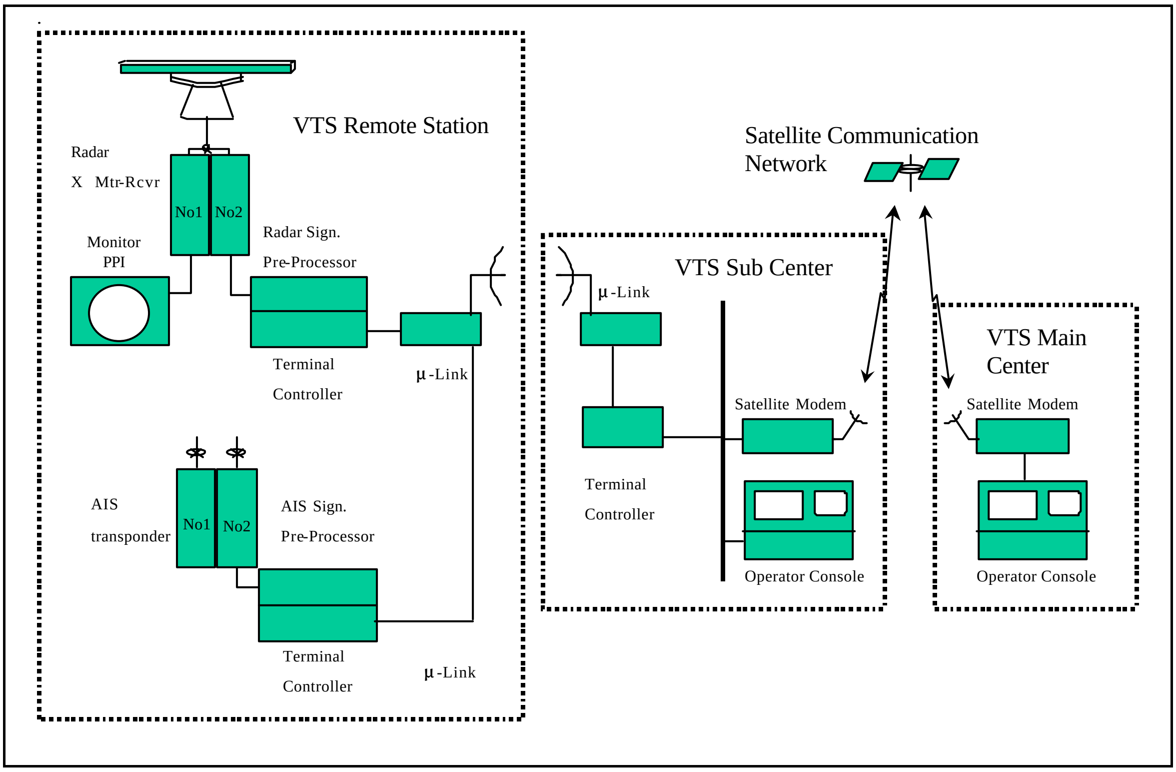


Figure 1.4.5.(4) Typical System Configuration-4



A typical system configuration having equipment for radar system of VTS System is shown as **Figure 1.4.5. (5).**

Figure 1.4.5.(5) Typical Configuration of VTS Radar System Including Communication Link



(2) System configuration of VTS System

① Plans of System configuration

Remote sites and Main/Sub Center sites are selected and service area of each remote sites are proposed in previous section. To attain those objectives, we prepare two (2) types of configuration of VTS System, one is Plan-A and the other is Plan-B. Plan-A is made to prepare the full functions for management of vessels navigating in sea-lane. Plan-B is made to prepare minimum functions for VTS system with lower investment cost.

Plan-A adopts the combined system of radar and AIS as sensor at twelve (12) remote sites and four (4) AIS remote sites where few vessels are navigating. Dumai and Surabaya access have the combined system of radar and AIS system as sensor. Targeted vessels are not limited to

SOLAS ships.

Plan-B adopts AIS as sensor at twelve (12) remote sites except the sea areas (Sunda and Lombok Strait area) where vessels are congested. Targeted vessels are limited to SOLAS ships except Sunda and Lombok Strait area.
System configuration of Plan-A is shown in **Figure 1.4.5(6)** and System configuration of Plan-B is shown **in Figure 1.4.5.(7)**.

Figure 1.4.5.(6) System Configuration of Plan-A

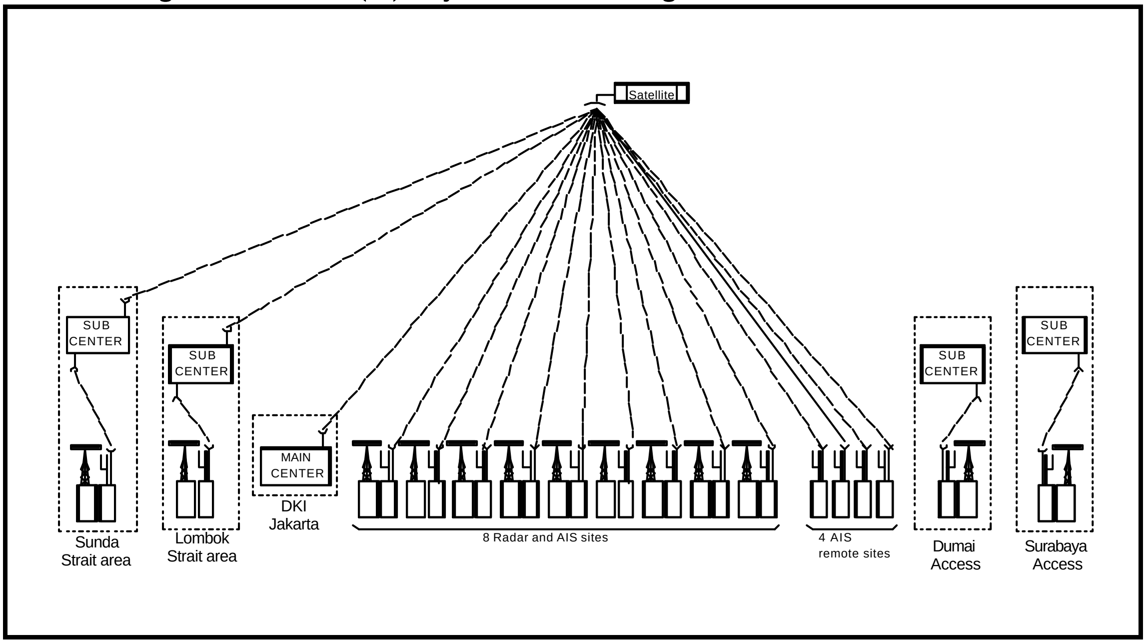
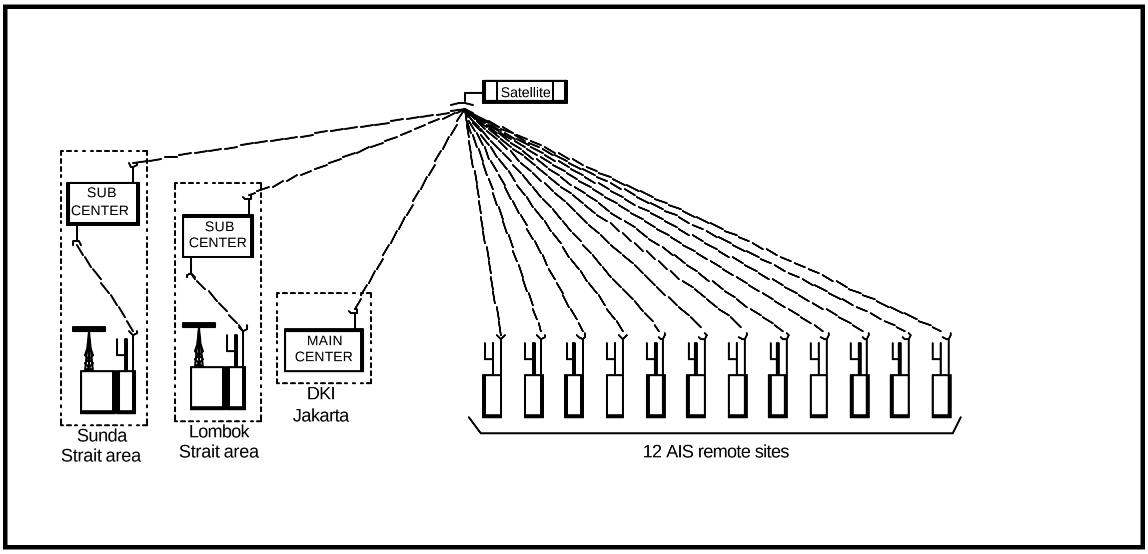


Figure 1.4.5.(7) System Configuration of Plan-B



Allocation plan of Radar and AIS for Plan-A/B is shown as **Figure 1.4.5. (8) and (9).** Equipment Plan of Plan-A and Plan-B is shown in **Table 1.4.5.(1)**, **Table 1.4.5.(2)**, **Table 1.4.5.(3)** and **Table 1.4.5.(4)**.

② Functions of Main Center and Sub Center.

Main Center:

Main Center is formulated in Jakarta and may communicate with Sub Center and remote sites through satellite communication system. Main Center should have the following functions:

- Data communication with Sub Center and remote sites.
- Display of position of vessels navigating sea-lanes.
- Processing of information received from vessels navigating in sea-lanes.
- Data communication with Sub Center.
- Receiving of information through Internet, FAX and Telephone.
- Oral communication with vessels by VHF marine radio.
- Functions of statistical processing such as to make yearly report, monthly report, daily report for sea-lane.

Sub Center:

Sub Center should have the following functions:

- Data communication with Main Center and remote sites.
- Display of position of vessels navigating targeted sea-area.
- Processing of information received from vessels navigating in targeted sea-areas.
- Data communication with remote site (Radar/AIS site).
- Receiving of information through Internet, FAX and Telephone.
- Oral communication with vessels by VHF marine radio.

Figure 1.4.5.(8) Allocation Plan of Radar and AIS for Plan-A

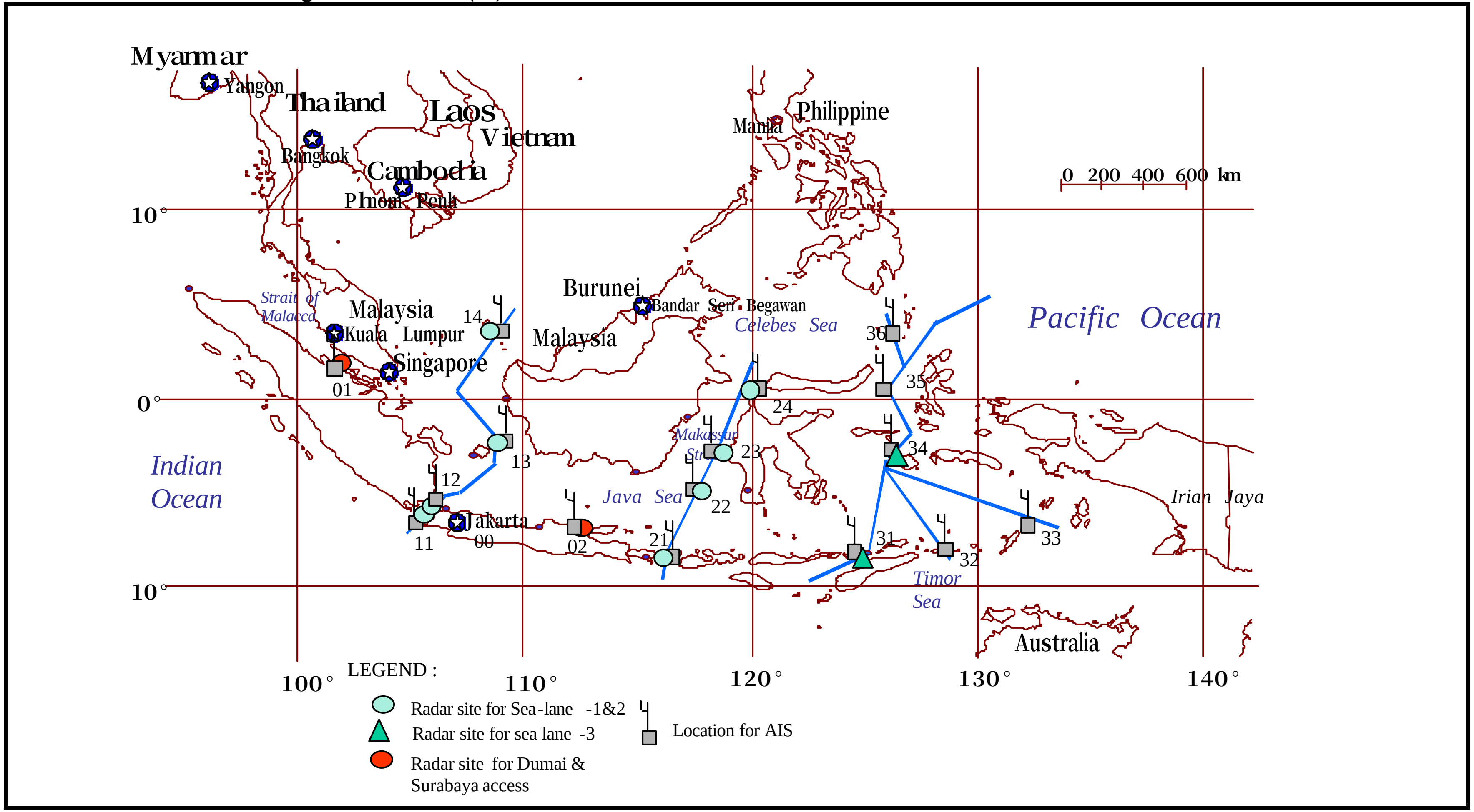
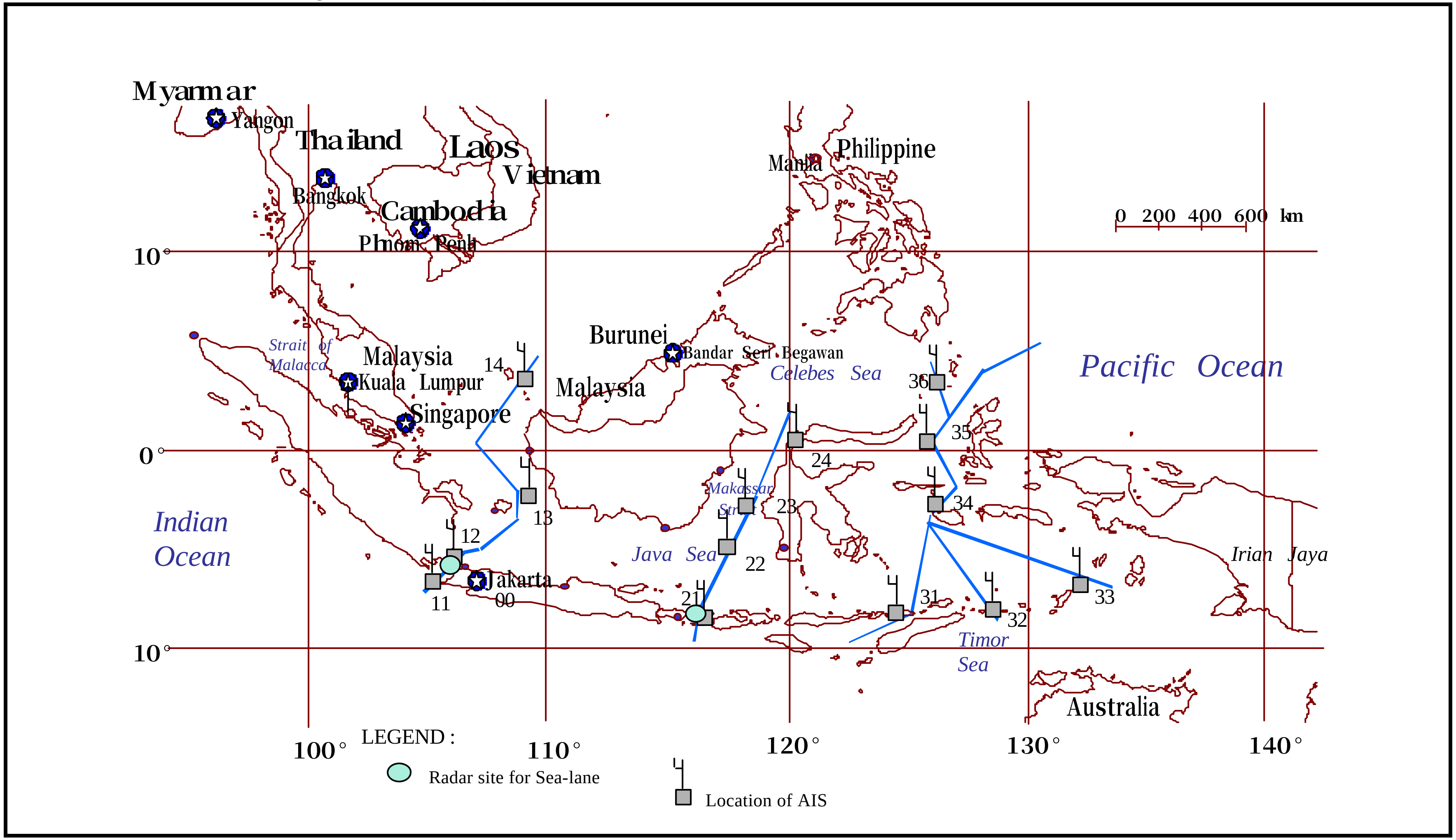


Figure 1.4.5.(9) Allocation Plan of Radar and AIS for Plan-B



(3) Equipment allocation plan

Equipment is allocated at each project site to attain objectives of VTS System. Equipment allocation plan of Radar, AIS and Center is shown in **Table 1.4.5.(1)**, **Table 1.4.5.(2)**, **Table 1.4.5.(3)** and **Table 1.4.5.(4)** for Plan-A and Plan-B respectively.

Table 1.4.5.(1) Equipment Plan for Plan-A (Remote Sites)

Site ID	Name of related sea lane	Name of Project site	Targeted water areas	Q'ty. of radar	Q'ty. of AIS
01	Malacca Strait	Dumai Access	Malacca Strait Area	2 sets	2 sets
02	Sea Lane II	Surabaya Access	Surabaya access area	3 sets	3 sets
11	Sea Lane I	Tanjung Lesung	Sunda Strait Area	1 set	1 set
12	Sea Lane I	Merak	Sunda Strait Area	1 set	1 set
13	Sea Lane I	Sarutu Island	Kalimata Strait Area	1 set	1 set
14	Sea Lane I	Natuna Island	Natuna Area	1 set	1 set
21	Sea Lane II	Tanglad	Lombok Strait Area	1 set	1 set
22	Sea Lane II	Kalukalukuang Island	South Makassar Area	1 set	1 set
23	Sea Lane II	Buttu Tuopoang	Central Makassar Area	1 set	1 set
24	Sea Lane II	Buttu Salome	North Makassar Area	1 set	1 set
31	Sea Lane III	Alor Island	Ombai Strait	1 set	1 set
32	Sea Lane III	Pulau Romang	Romang Strait Area		1 set
33	Sea Lane III	Molu Island	Banda Sea Area		1 set
34	Sea Lane III	Sulabes Island	Banda Sea Area	1 set	1 set
35	Sea Lane III	Mayu Island	Moluca Sea Area		1 set
36	Sea Lane III	Maru Island	Pulau Maru Sea Area		1 set

Table 1.4.5.(2) Equipment Plan for Plan-A (Main or Sub Center)

Site ID	Name of related sea lane	Name of Project site	Targeted water areas	Q'ty. of equipment for Center
000	All sea lanes	Main Center	All area	1 set
001	Sea Lane I	Sub Center	Sunda Strait area	1 set
002	Sea Lane II	Sub Center	Lombok Strait area	1 set
003	Malacca Singapore	Sub Center	Dumai access	1 set
004	Sea Lane II	Sub Center	Surabaya access	1 set

Table 1.4.5.(3) Equipment Plan for Plan-B (Remote Sites)

Site ID	Name of sea lane	Name of Project site	Phase	Targeted water areas	Q'ty of radar	Q'ty of AIS
11	Sea Lane I	Tanjung Lesung	3	Sunda Strait Area		1 set
12	Sea Lane I	Merak	1	Sunda Strait Area	1 set	1 set
13	Sea Lane I	Sarutu Island	3	Kalimata Strait Area		1 set
14	Sea Lane I	Natuna Island	2	Natuna Area		1 set
21	Sea Lane II	Tanglad -AIS	1	Lombok Strait Area		1 set
21	Sea Lane II	Tanglad -Radar	2	Lombok Strait Area	1 set	
22	Sea Lane II	Kalukalukuang Island	3	South Makassar Area		1 set
23	Sea Lane II	Buttu Tuopoang	3	Central Makassar Area		1 set
24	Sea Lane II	Buttu Salome	2	North Makassar Area		1 set
31	Sea Lane III	Alor island	2	Lombok strait		1 set
32	Sea Lane III	Pulau Romang	3	Romang Strait Area		1 set
33	Sea Lane III	Molu Island	3	Banda Sea Area		1 set
34	Sea Lane III	Sulabes Island	4	Banda sea Area		1 set
35	Sea Lane III	Mayu Island	4	Moluca Sea Area		1 set
36	Sea Lane III	Maru Island	3	Pulau Maru Sea Area		1 set

Table 1.4.5.(4) Equipment Plan for Plan-B (Main or Sub Center)

Site ID	Name of sea lane	Name of Project site	Phase	Targeted water areas	Q'ty of equipment for Center
000	All sea lanes	Main Center	2,3,4	All area	1 set
003	Sea Lane I	Sub Center	1	Sunda strait area	1 set
004	Sea Lane II	Sub Center	1	Lombok strait area	1 set

(4) 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. Even though Plan-B expects to reduce investment cost, there is some limitation of functions. Comparison of Functions for Radar and AIS is shown in **Table 1.4.5.(5)** as follows:

Table 1.4.5 .(5) Comparison List of Functions for Radar and AIS

Description	Radar	AIS	Remarks
Detection of Vessels not installed AIS	Good	No	
Grasping automatically data of vessel (Ex. speed, name of vessels, kind of cargo, etc).	No	Good	
Power consumption	High	Low	
Installation Cost	High	Low	
Speed of data transmission line	High	Low	
Finalization of Specification of equipment	Completed	Not yet	

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 cost than Plan-A. In case AIS is adopted as sensor at remote site, the advantage and disadvantage are shown in **Table 1.4.5.(6)** as follows:

Table 1.4.5.(6) Comparison List for Advantage and Disadvantage of AIS

Advantage	Disadvantage
1. Power Consumption of AIS is lower than Radar because receiving time and transmission period is short. 2. Degradation of performance caused by rain is not occurred because AIS is using maritime mobile VHF radio. 3. Total investment cost is much lower. 4. Position accuracy is better than Radar because position accuracy of AIS is ±10m when in case of using DGPS. 5. Easy Maintenance is expected because AIS equipment is simple configuration than Radar.	1. In some case, data acquisition rate is lower than radar. 2. AIS will be not installed for all of the ships, only for SOLAS ships. 3. As of December 2001, detailed specification of AIS is not yet concreted. Practical system is now under schedule.

Even though Plan-A has been planned to formulate VTS System at Dumai and Surabaya Access, Port VTS is suitable to be formulated at near of port area. Formulation of VTS System for Dumai and Surabaya are eliminated from plan as follows:

Table 1.4.5.(7) List of Service Area by Plan -A or Plan-B

Sea area	Plan-A	Plan-B	Cause of elimination
Dumai Access	Yes	No	Formulation of Port VTS is suitable because this system is planed near Dumai port.
Surabaya Access	Yes	No	Formulation of Port VTS is suitable because this system is planed near Dumai port.
Sea Lane Ⅰ	Yes	Yes	
Sea Lane Ⅱ	Yes	Yes	
Sea Lane Ⅲ	Yes	Yes	

(5) Additional study of Plan-B for sea-lane areas

VTS System will be formulated to monitor vessels navigating in the sea-lane area having marine traffic congested area. The possibility of marine accident may be decreased by the assistance of the VTS Center that can give efficient information to vessels by the communication facilities.

Of course, it is useful and desirable that sea-areas are covered perfectly by monitoring system such as a combined system of radar and AIS. By adoption of this system, VTS Center is able to grasp information of every vessel's position in the targeted area at any time. However, it is not indispensable condition but desirable condition.

Basic concept of Plan-B is as follows:

① For most part of the sea-lane areas, AIS stations should be installed to grasp surrounding vessel's position data.

② For the congested area, one radar and AIS station (combined system) should be installed in order to monitor vessels as many as possible.

VTS System cannot restrict its service only to the vessels having AIS. All kinds of the vessels is not obliged to install AIS. So that, radar system will be necessary in order to serve every vessel in the area equally.

VTS remote station having radar and AIS is localized only in the area near the congested area, but remaining part of the sea traffic route may be covered by AIS station.

1.4.6. Selection of Master Plan from Plans

(1) General

VTS System was installed in many countries and contributed to secure safe navigation and to improve efficient navigation. Radar is adopted as sensor for those VTS System.

AIS was introduced as sensor of VTS System. Detailed specification of AIS is December 2001 under discussion by international members and will be made concrete in the near future. Usage and application of AIS will be spread worldwide in the near future. AIS will be realized today only by VHF frequency band. When AIS will adopt satellite communication band, service coverage of AIS will be wider up to more than one (1) hundred kilometer. Proposed AIS system will be improved to cover wider area.

(2) Circumstance of sea lane

Main role of VTS System is as follows:

- VTS Center gives vessels the safety information that was gathered by operator.
- VTS Center manages navigation of vessels in dangerous waters.

Width of Sea-lanes is not narrow for safety navigation except Sunda Strait, Lombok Strait, Kalimata Strait and Part of Oil field located at North of Sunda Strait. It means that no limitation is required for safe navigation except the foresaid sea area.

Marine casualties of collision and grounding related with sea-areas are occurred in Sunda and Lombok Strait as shown as **Figure 1.4.2.(4).** Casualty is not found in other point of sea lanes. This means that there is possibility to avoid casualty by surveillance and management of vessels in Sunda and Lombok Strait.

On the other hand, surveillance of vessels navigating in sea-lane is role of DGSC to secure safe navigation. To attain this purpose, VTS remote station should be formulated besides Sea Lane I, II, and III.

(3) Comparison of functions for Plan-A and Plan-B

Comparison of functions is shown in **Table 1.4.6.(1)**.

Table 1.4.6.(1) Comparison List of Functions

	Plan-A	**Plan-B**
Adoption of Sensor	Radar and AIS combined system except site ID 32, 33, 35 and 36.	Sunda and Lombok Strait: Radar and AIS combined system. Other area: Only AIS.
Taget Vessels	All vessels including no AIS except site ID 32, 33, 35 and 36.	Sunda and Lombok Strait: All vessels including no AIS. Other area: Vessels having AIS.
Area for Information Service	Within service area of Radar or AIS.	Area only for Sunda and Lombok Strait
Investment Cost	Expensive.	Reasonable
Learning of technical terms for Operation and Maintenance	Difficult	Practicable

Vessel position can be decided precisely in case vessels have AIS equipment. But position of small vessels cannot be decided because those vessels have no AIS. Accordingly, Plan-B shown as **Figure 1.4.5.(9)** has one (1) radar that is installed in the most congested area (Sunda Strait) to decide the position of small vessels. In addition, one (1) radar will be installed at Lombok Strait in 2nd Phase of this Master Plan.

Plan-A has twelve (12) radars that will be installed at VTS remote station for Sea Lane Ⅰ, Ⅱ and Ⅲ as shown as **Figure 1.4.5.(8)** This is meaning that Plan-A has strong functions to decide position of small vessels at any time. Even though DGSC has strong functions to manage vessels navigating sea lanes, investment and O/M cost will be expensive.

(4) Proposed Plan as Master Plan

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 Proposed system configuration of Master Plan is shown in **Figure 1.4.5.(7)** and equipment of Master Plan is summarized in **Table 1.4.5.(3)**.

1.4.7. Equipment Specification

(1) Radar System

The Radar System is installed at radar site. The X-Band Radar with large size antenna is fitted to observe long range. Detailed specifications of equipment installed at radar site are as follows;

① Radar Antenna

Antenna type is Slotted Array type or Reflector type which is selected according to the radar site condition. Horizontal Polarization or Horizontal/ Circular switch-able is selected according to the radar site condition. Detail of specifications are as follows;

• Horizontal beam width:	0.35° or less
• Vertical beam width:	12.5°
• Antenna gain:	35dB
• Side-lobe reduction:	more than -23dB
• Rotation speed:	10 rpm
• Angle Encoder:	4096p/r
• Wind loading:	Survival; Up to 51.4m/s (100 knots). Operational; Up to 34.5m/s (67 knots)
• Power supply:	AC220V, 3 phase, 50/ 60Hz

② Radar Transmitter- Receiver

Radar transmitter-Receiver is located as near as possible to the radar scanner in order to minimize RF losses.
Details of specifications are as follows;

• Exchange of duty/standby:	Automatic/Manual
• Frequency:	X band
• Peak Power Output:	40 kW, nominal
• Pulse Width:	0.3μS
• Pulse Repetition:	1200 pps

To protect the other radar against interference and 2nd time around echoes, pulse repetition agility is provided.

- Wave-guide: RG51/U or equivalent
- Front-end: RF amplifier
- Noise Figure: 6dB nominal
- Local Oscillator: Manual or Automatic
- IF amplifier: Bandwidth 5MHz, 60dB or more dynamic range logarithmic
- Power Supply: AC220V, 50/ 60Hz

③ PPI Monitor

The PPI monitor is provided for maintenance of radar system at radar site.

- Type of Monitor: Desktop type, Monochrome
- Display size: 15 inch

④ Radar Signal Preprocessor

- Detection of target: Automatically
- Processing of radar image: Automatically tracking and plotting
- Applicable targets: 300 targets/radar maximum

⑤ Radar Terminal Controller

Radar Terminal Controller is installed at sub center and has two functions as follows;

- One is to control remotely radar equipment and subsidiary equipment installed at remote radar site from sub center,
- Other is processing function for radar image. This controller processes the received radar image and data size is compressed to 64kbps at Sub Center to minimize the data transmission cost.

(2) VHF Radio system

The VHF radio transceiver is installed and used to communicate with vessels. Detail of functions is as follows;

- Type: Marine use
- Channel Oscillator: Syschesizer oscillator is applied.
- Number of Channels: CH16 with variable 8 channels min.
- Duty and Standby: Shall be applicable.
- Antenna type: 1/4 λ long sleeve.
- Remote control functions: Shall be provided.
- Remote control items: Channel, Power high and low, Power On/OFF

(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. Detail of specification is as follows:

- Main protocol: SOTDMA
- Modulation: GMSK 9600 bps
- Frequencies: AIS 1 & 2
- Control channel: CH70 DSC
- Antenna type: 1/4 λ long sleeve
- Signal mode: Navigational dynamic data

(4) Sub Center System

Sub center comprises of equipment as follows;

① Operator Console
- Type of display: Color CRT
- Display size: 24 inches
- Number of pixels: 1024×1280
- Keyboard: Alphanumeric keyboard
- Mouse: 3 button type

② Terminal Controller

③ Radar data Processor: Refresh cycle time 6sec

④ AIS data terminal

⑤ Satellite modem for MAIN Center

⑥ VHF Controller

(5) Main Center System

Main center comprises of equipment as follows;

① Operator Console
- Display format: Customized Fixed Format
- Display data: Maritime traffic data and traffic information supplemental data.
- Full PC optional system is available such as screen display, printer, fax, vessel traffic plotting, automatic broadcasting, and so on

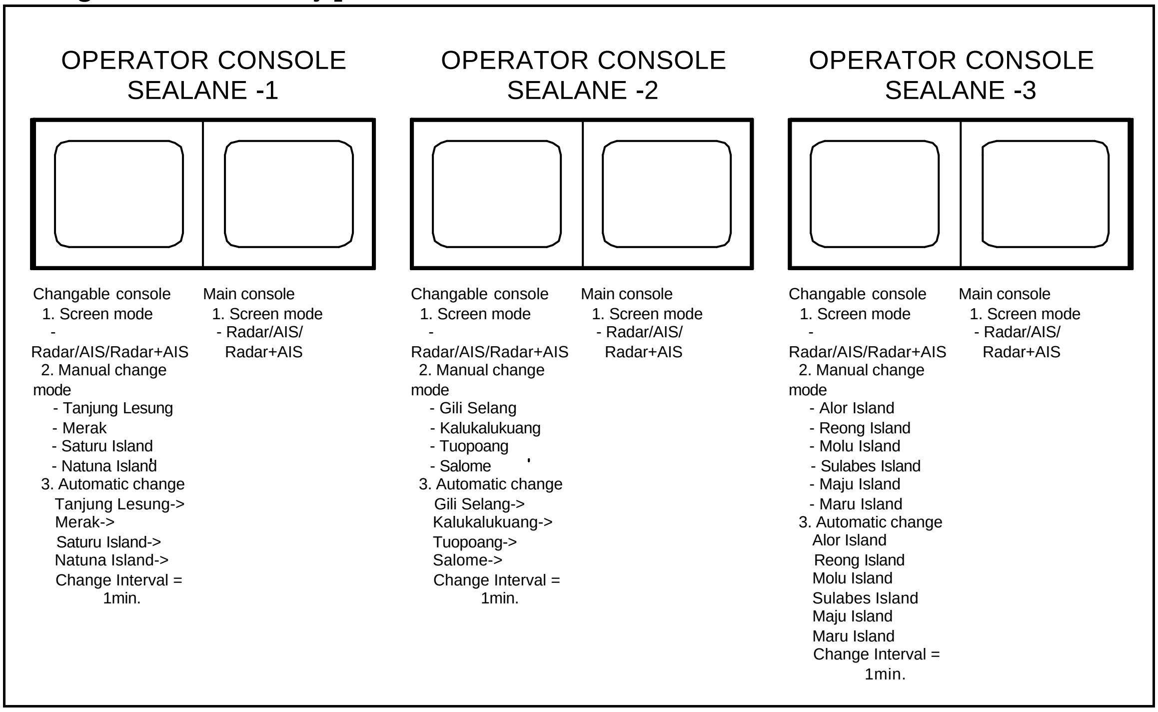
② Terminal Controller

③ Satellite communication modem for Sub-Center and AIS remote station.

④ Functions of Operation console

Typical functions of Operation console are equipped for Main Center as follows:

Figure 1.4.7. Typical Functions of Console for Main Center



(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 remote site and Sub center.

- Frequency band: 7.5GHz band
- Required channels: 8 CHs
- Power supply: AC220V, 50/60Hz

1.4.8. 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 comprises 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) Project site for Radar and AIS sites

The proposed positions for project sites were selected by map survey and summarized in **Table 1.4.8.(1).**

Table 1.4.8.(1) Location and Altitude of Proposed Project Sites

Site ID	Name of related sea lane	Name of Project site	Location		
			Latitude	Longitude	Altitude (m)
	Sea Lane I	Tanjung Lesung	06-32-00S	105-39-00E	130
12	Sea Lane I	Merak	05-55-35S	105-59-58E	134
13	Sea Lane I	Pulau Sarutu	01-42-00S	108-43-00E	425
14	Sea Lane I	Pulau Natuna	03-39-00N	108-10-00E	600
21	Sea Lane II	Tanglad	08-46-57S	115-35-40E	433
22	Sea Lane II	Pulau Kalukalukuang	05-11-32S	117-40-33E	10
23	Sea Lane II	Buttu Tuopoang	03-06-00S	118-52-00E	385
24	Sea Lane II	Buttu Salome	00-27-00N	119-54-00E	310
31	Sea Lane III	Pulau Alor	08-15-21S	125-06-00E	550
32	Sea Lane III	Pulau Romang	07-40-00S	126-46-44E	500
33	Sea Lane III	Pulau Molu	06-40-00S	131-35-20E	125
34	Sea Lane III	Pulau Sulabes	02-26-00S	126-02-38E	600
35	Sea Lane III	Pulau Mayu	01-19-05N	126-23-10E	400
36	Sea Lane III	Pulau Maru	04-45-00N	125-28-37E	300

Map and hydrographic chart were studied deeply to find the suitable position in Pulau Kalukalukuang (Site ID: 22) and we finally decided present position shown in **Table 1.4.8.(1)** even though altitude of position is 10m high.

(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 radar equipment, radar scanner, satellite communication equipment, engine generator and other relative equipment. One house is needed for site keepers for daily maintenance and guard of equipment. Typical layout is shown as **Figure 1.4.8.(3).**

Leveling works for project site is required approx. 1200m^2 where equipment house, radar house, keeper's house and others are constructed. The premise is surrounded by fence.

② In case only AIS is equipped:

Equipment house and antenna pole are mainly constructed to install AIS equipment and battery power supply system including small size engine generator. Solar cell power supply system is adopted for AIS station to reduce maintenance cost. Typical layout is shown as **Figure 1.4.8.(2).**

Leveling of project site is approx. 900m^2. House and antenna pole are surrounded by high fence to avoid robbery for equipment because of no guard man. It means that the premise is surrounded by fence.

(4) Access Road and Landing piers

Access road is constructed for forwarding materials including equipment such as radar antenna, antenna tower, engine generator, materials for equipment house and others.

Landing pier is constructed to forward materials including equipment at isolated island where there is little population.

When access road and landing pier have been constructed, easy access to site is useful for maintenance of equipment by DGSC maintenance staff.

Estimated access road and landing pier including other civil works for each site is shown in **Table 1.4.8.(2).**

Table 1.4.8.(2) Summarized Civil Works at Project Site

Site ID	Site Name	Province	Altitude (m)	Tower Height (m)	Access road (km)	Landing pier (m)	Leveling of site (m^2)	Equipment and EG house (m^2)
11	Tanjung Lesung	Jawa Barat	130	35	3.5	0	900	56
12	Merak	Jawa Barat	134	20	1.5	0	1,200	105
13	Pulau Sarutu	West Kalimantan	425	35	5.5	40	900	56
14	Pulau Natuna	North West Kalimantan	600	20	6.0	40	900	56
21	Tanglad	Nusa Penida	433	20	0	0	1,200	105
22	Pulau Kalukalukuang	South Sulawesi	10	100	0.2	40	1,200	56
23	Buttu Tuopoang	South Sulawesi	385	35	5.0	0	900	56
24	Buttu Salome	Central Sulawesi	310	35	3.5	0	900	56
31	Pulau Alor	Nusa Tenggara	550	20	7.0	0	900	56
32	Pulau Romang	Maluku	500	20	3.0	0	900	56
33	Pulau Molu	Maluku	125	100	3.0	40	1200	56
34	Pulau Sulabes	Maluku Utara	600	20	5.0	0	900	56
35	Pulau Mayu	Maluku Utara	400	20	5.0	0	900	56
36	Pulau Maru	Sulawesi Utara	300	20	1.0	40	900	56

(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. Typical tower for remote sites is shown in **Figure 1.4.8.(1).**

Two (2) type of site layout is 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. Those site layouts are shown in **Figure 1.4.8.(2).** and **Figure 1.4.8.(3)** respectively.

Figure 1.4.8.(1) Typical Radar Tower

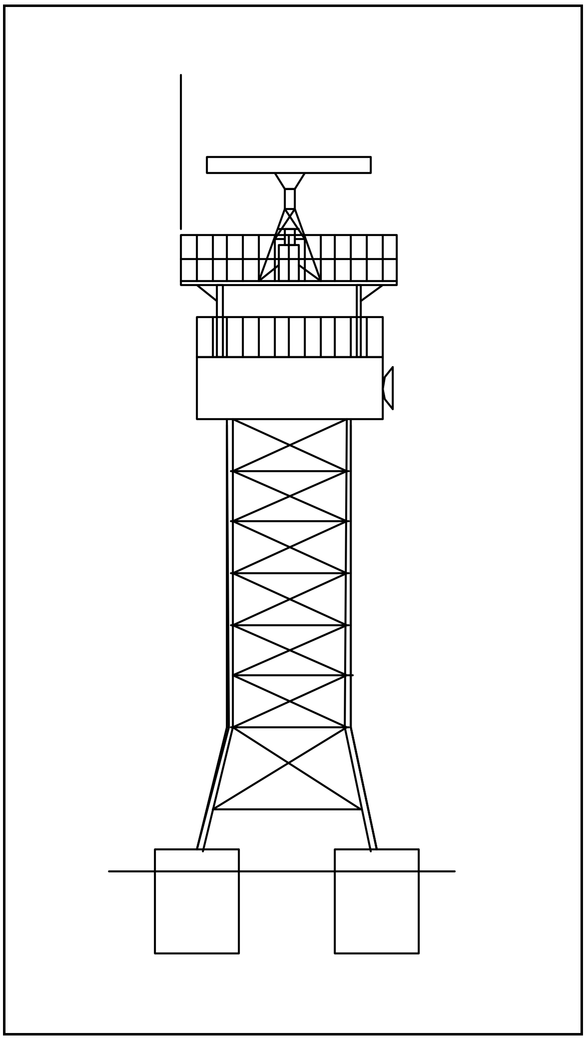


Figure 1.4.8.(2) Typical Layout of AIS Shore Station Site

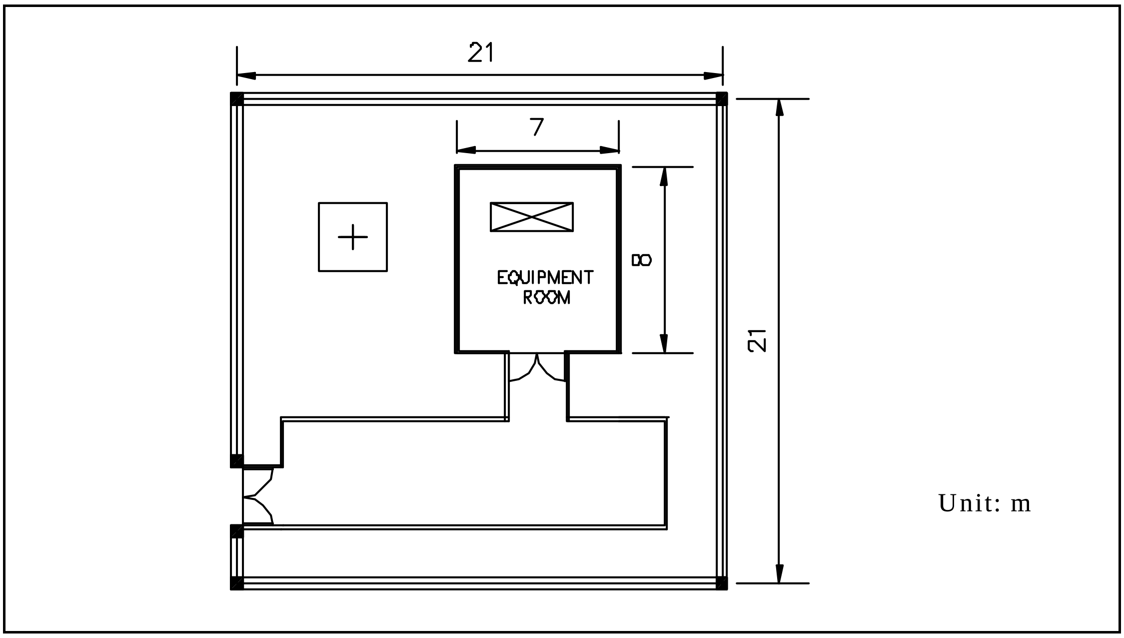
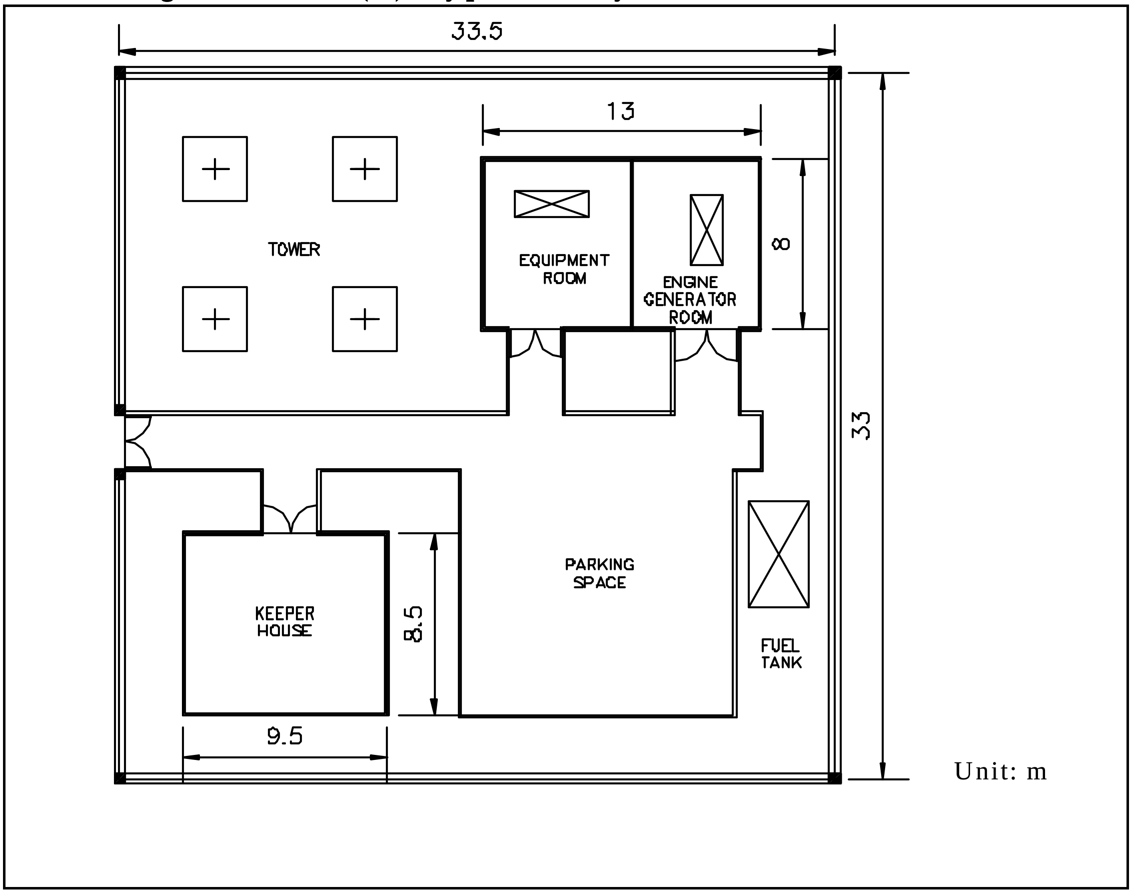


Figure 1.4.8.(3) Typical Layout for Radar Site



1.4.9. 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 for 24-hour bases. 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 1.4.9.(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 follows:

Table 1.4.9.(1) Summarized Personnel for Main Center Group

	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 1.4.9.(2).**

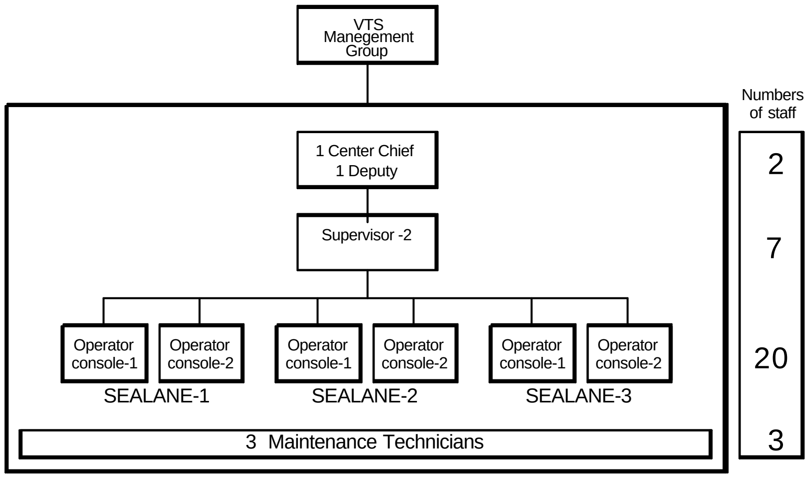
Summarized personnel for Operation and Maintenance group is as follows:

- Center chief: 1 person
- Deputy: 1 person
- Maintenance Technician: 3 persons
- Supervisor and Operators: as follows:

Table 1.4.9.(2) Summarized Personnel for Operation and Maintenance Group

	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

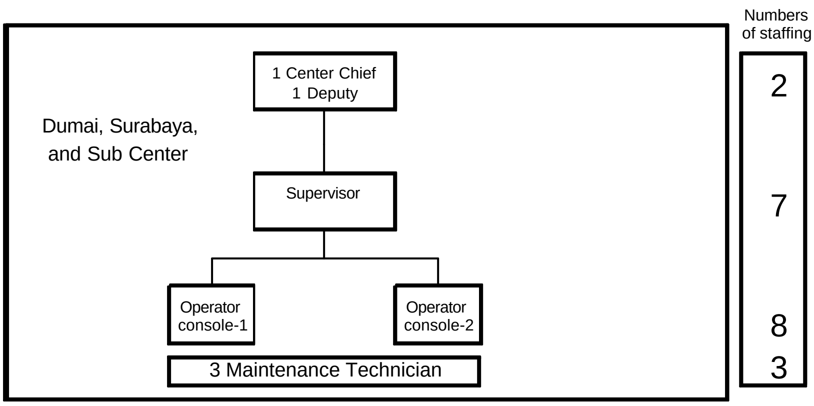
Figure 1.4.9 .(1) Organization of O/M of VTS System for Main Center



Note)
(1). 1 Operators for 2 consoles
(2). 3 Shifts for 24 hours
(3). 2 Backup operators for 6 consoles
(4). 1 Supervisor for 6 consoles
(5). 3 Shifts for 24 hours
(6). 1 backup supervisor for 6 consoles

Note 2)
(1). 1 Center chief
(2). 1 Deputy
(3). 3 Maitenance Technicians

Figure 1.4.9 .(2) Organization of O/M of VTS System for Sub Center



Note 1)
(1). 1 Operators for 2 consoles
(2). 3 Shifts for 24 hours
(3). 2 Backup operator for 2 console
(4). 1 Supervisor for 2 consoles
(5). 3 Shifts for 24 hours

Note 2)
(1). 1 Deputy

(2) Training for Operation staff

Training for Operator and Supervisor staff should be completed before the commissioning test of VTS system. Training program comprises of two categories, one is "class room training" to study general items as maritime regulation, concept of VTS system, management of vessel traffic, IALA VTS guideline, IMO regulation, sea-lane and others.

The other is "On-the-Job", which is the 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 comprises 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.

1.4.10. Implementation Schedule

The location of project sites spreads nation widely. Phasing of schedule is useful for actual implementation work. Implementation schedule is divided into four phases.

Installation schedule for each phase is shown as **Table 1.4.10.(1).** Formulation of VTS System is scheduled as follows:

- Sub Center having remote station is formulated at Sunda and Lombok Strait area in the first phase.
- Main Center having three (3) remote stations is formulated in the second phase. Function of Tanglad remote station is also enforced by installation of radar equipment in the second phase.
- Seven (7) remote stations are installed in the third phase. Improvement of Main Center is done for control of seven (7) remote stations installed in third phase.
- Two (2) remote stations are installed and improvement of Main Center is done for control of two (2) remote stations installed in fourth phase.

Detailed time schedule of implementation is shown in **Table 1.4.10.(2).**

Table 1.4.10.(1) Installation Schedule for Each Phase

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).

Table 1.4.10.(2) Implementation Time Schedu le

Site ID	Name of Sealane	Site Name	Taqrgeted Sea Area	Year																
				2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
000	All Sealane	Jakarta	All Sea area																	
003	Sea-lane -I	Merak ADPEL Sub Center	Sunda Strait Area																	
004	Sea-lane -II	Benoa C/S Sub Center	Lombok Strait Area																	
11	Sealane - I	Tanjung Lesung	Sunda Strait Area																	
12	Sealane - I	Merak	Sunda Strait Area																	
13	Sealane - I	Sarutu Island	Kalimata Strait Area																	
14	Sealane - I	Natuna Island	Natuna Sea area																	
21	Sealane - II	Tanglad AIS	Lombok Strait Area																	
21	Sealane - II	Tanglad radar	Lombok Strait Area																	
22	Sealane - II	Kalukalukuang Island	South Makassar Area																	
23	Sealane - II	Buttu Tuopoang	Centrral Makassar Area																	
24	Sealane - II	Buttu Salonte	North Makassar Area																	
31	Sealane - III	Alor island	Ombai Strait Area																	
32	Sealane - III	Pulau Reong	Romang Strait Area																	
33	Sealane - III	Molu Island	Banda Sea area																	
34	Sealane - III	Sulabes Island	Banda Sea area																	
35	Sealane - III	Mayu Island	Moluca Sea area																	
36	Sealane - III	Maru Island	Pulau Maru Sea area																	

1.4.11 Project Cost Estimation

(1) General

Plan-B is decided as Master Plan that is comprised of one (1) Main Center, two (2) Sub Center, two (2) Radar and AIS station sites and twelve (12) AIS remote station sites.

Main Center is located at Jakarta in Jawa island. 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 Radio Station in Bali Island.

(2) Project Cost Estimation

Mater Plan will be formulated by four (4) phases as specified in **Table 1.4.10.(2)** Project cost is estimated for each phase. Investment cost for each phase of Master Plan is shown in **Table 1.4.11.**

Table 1.4.11 Summarized Project Cost of Master Plan

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

(3) Summarized Equipment for each project sites.

Equipment of Master Plan is summarized and shown in **Table 1.4.5 .(3) and (4).**

1.5. GMDSS Expansion and Improvement

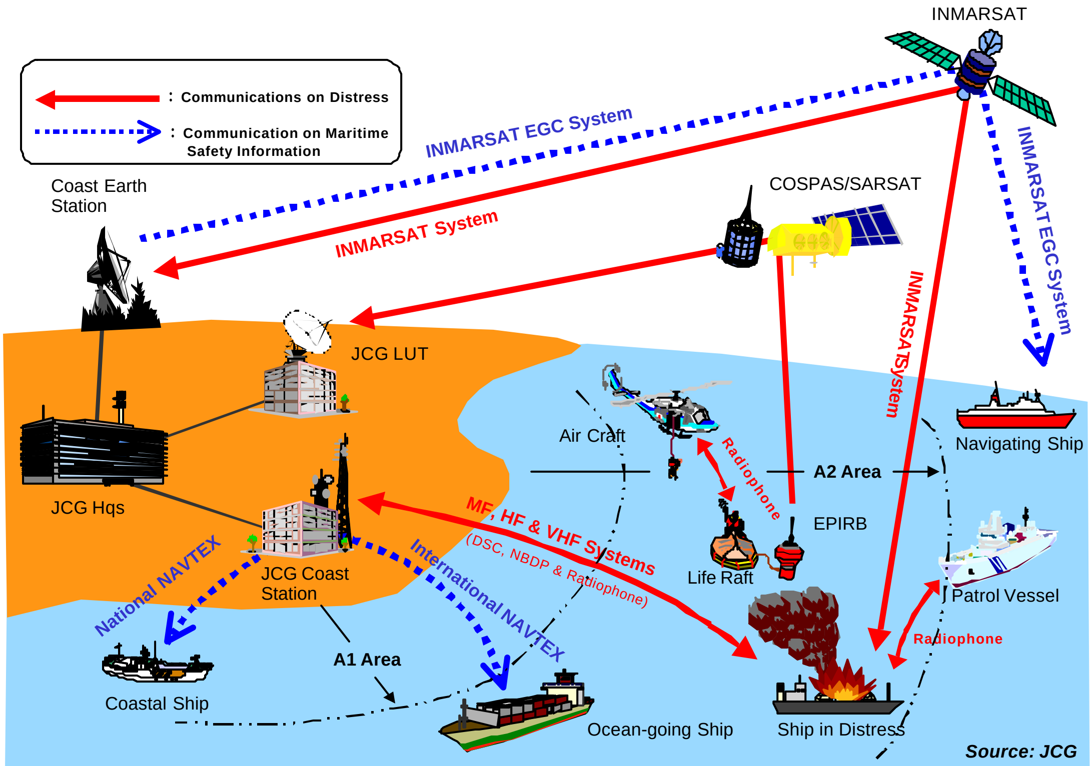
1.5.1. Introduction

Although the conventional maritime distress and safety communication system, mainly using Morse codes such as SOS and TTT, has contributed to the safety of life at sea for a long time, some problems have been pointed out. The conventional system is inadequate for long-distance communication, and no distress signal is transmitted if a vessel is capsized abruptly.

To solve these problems, International Maritime Organization (IMO) and other related organizations have developed the Global Maritime Distress and Safety System (GMDSS) using digital and satellite communications technologies.

GMDSS allows a vessel in distress in any sea area to make a quick and secure request for rescue to maritime SAR authorities and vessels passing in the vicinity. In addition, the GMDSS allows the vessels in the vicinity to obtain maritime safety information available from the shore at any time with high accuracy using the automatic receiving system. **Figure 1.5.1.** shows the concept of GMDSS.

Figure 1.5.1. Concept of GMDSS



For the full coverage by the GMDSS, the sea areas in the world are divided into four ship's areas of operation as follows:

Area A1 – within range of shore-based VHF coast stations (about 25 nautical miles)
Area A2 – within range of shore-based MF coast stations (about 150 nautical miles)
Area A3 – within range of service by INMARSAT, which covers the whole globe except for polar regions
Area A4 – the remaining sea areas outside of the Areas A1, A2 and A3

GMDSS was put into service in February 1992 and fully implemented in February 1999 in accordance with the regulations under the SOLAS Convention.

Thus, also in Indonesia, the vessels that are regulated under the SOLAS Convention have equipped with GMDSS equipment. For shore-based facilities, BASARNAS established COSPAS/SARSAT Local User Terminals (LUT) at two sites in Jakarta and Ambon, while DGSC is also promoting to provide the required coast stations with GMDSS installations such as digital selective calling (DSC), narrow band direct printing (NBDP) and navigation telex (NAVTEX) equipment.

1.5.2. Current Situation of GMDSS Coverage

As for GMDSS shore-based facilities, DGSC installed HF DSC at 12 stations, MF and VHF DSCs at 30 stations and NAVTEX transmitters at 4 stations under the Maritime Telecommunication System Project Phase Ⅲ and other projects.

Table 1.5.1. shows the list of coast stations where GMDSS is installed at present, and **Figure 1.5.2.** shows locations of the GMDSS stations.

(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 at Sumatera, 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 provisions of VHF DSC equipment.

Table 1.5.1. 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	

(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 1.5.3.**

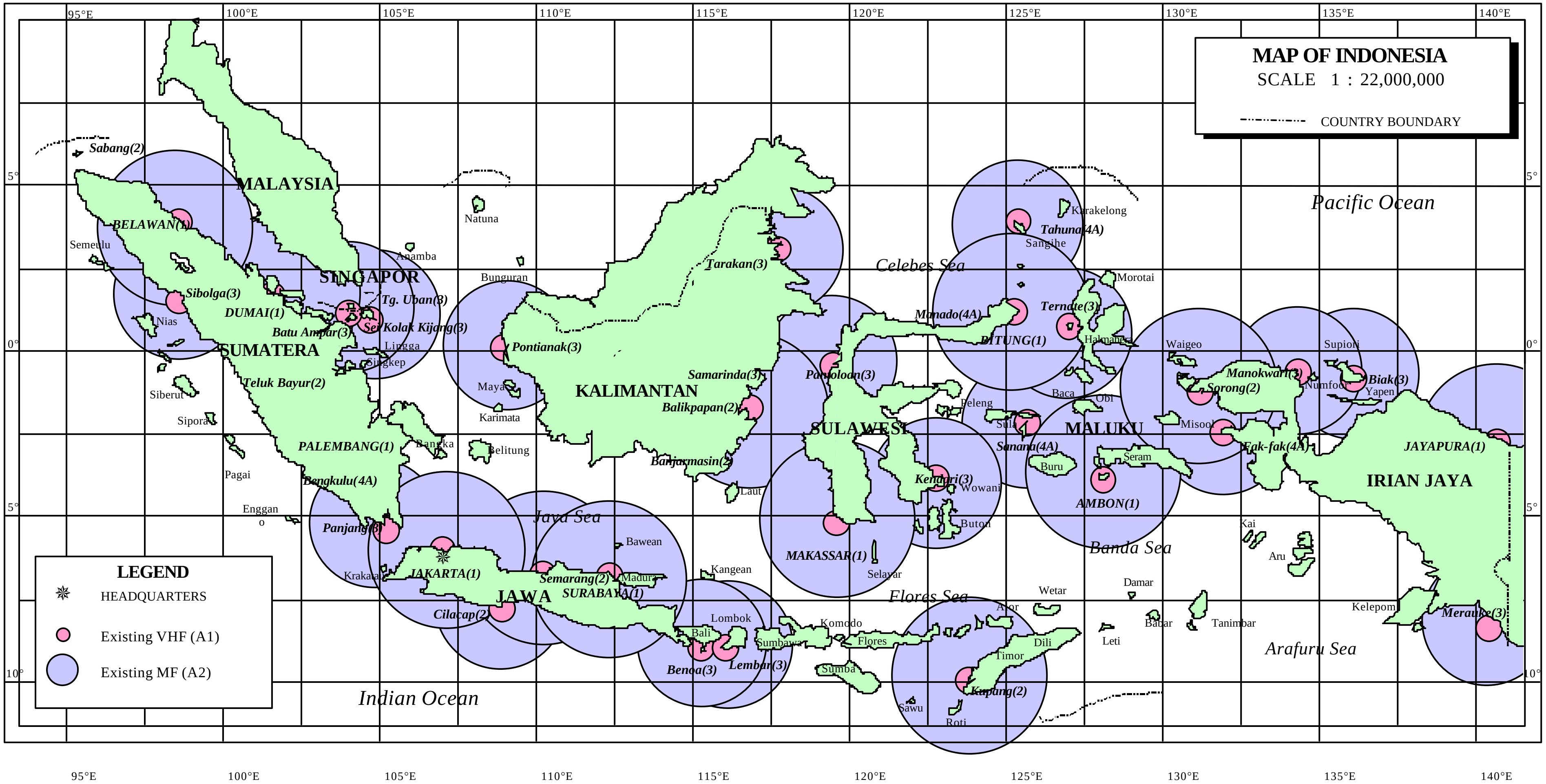
However, National NAVTEX which are being serviced in many non-English countries in order to secure the safety of navigation for coastal and inter-islands shipping, has not been established yet in Indonesia. **Table 1.5.2.** shows NAVTEX services in the world where national language is provided.

Table 1.5.2. NAVTEX Services in the World where National Language is Provided

NAV/MET Area	Country	Frequency		Language		Status	Remarks
I	Iceland	518 kHz		English		Operational	
			490 kHz		Icelandic	Operational	
	UK	518 kHz		English		Operational	
			490 kHz		English	Trial	
II	France	518 kHz		English		Operational	
			490 kHz		French	Trial	
	Spain	518 kHz		English	Spanish	Operational	
III	Greece	518 kHz		English	Greek	Operational	
	Italy	518 kHz		English	Italian	Trial	
VI	Argentine	518 kHz		English	Spanish	Operational	
	Uruguay	518 kHz		English	Spanish	Operational	
			490 kHz		Spanish	Operational	
IX	Egypt	518 kHz		English		Operational	
			4 MHz		English	Operational	0750, 1150 UTC
XI	China	518 kHz		English	Chinese	Operational	
	Japan	518 kHz		English		Operational	
			*424 kHz		Japanese	Operational	* specially assigned
	Korea	518 kHz		English		Operational	
			490 kHz		Korean	Operational	
	Vietnam	518 kHz		English		Operational	
			490 kHz		Vietnamese	Operational	0340, 1540 UTC
			4 MHz		English	Operational	
XV	Chile	518 kHz		English	Spanish	Operational	English 3 times/day Spanish 3 times/day
XVI	Peru	518 kHz		English	Spanish	Operational	

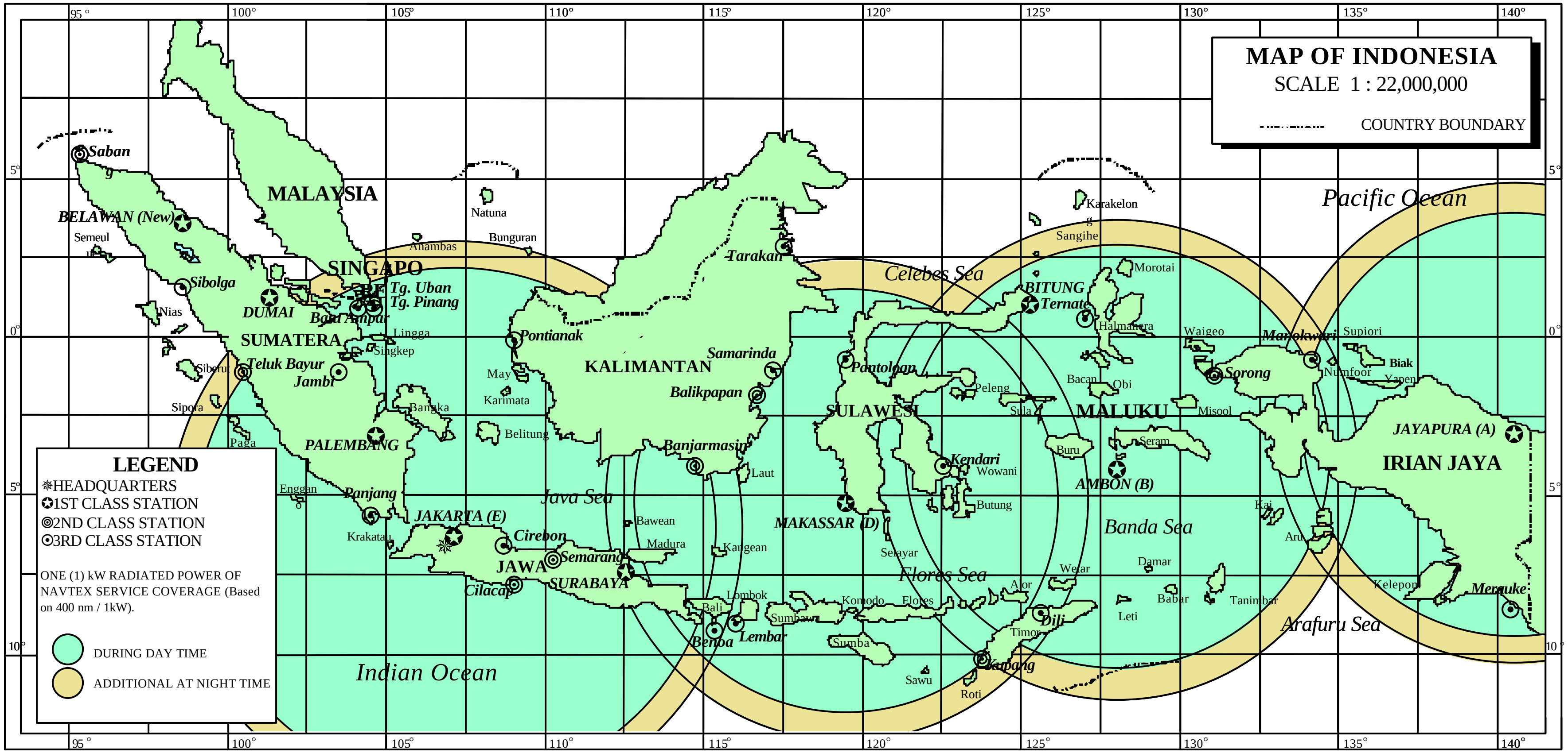
Source: IMO GMDSS Master Plan (Feb 28, 2001)

Figure 1.5.2. GMDSS Coverage Area (at Present)



Remarks: A3 area is covered by Belawan, Dumai, Jakarta, Surabaya, Makassar, Bitung, Ambon, Jayapura, Semarang, Kupang, Balikpapan and Sorong.

Figure 1.5.3. NAVTEX Coverage Area (at Present)



1.5.3 Concept of GMDSS Expansion and Improvement

Amendments to the 1974 SOLAS Convention concerning GMDSS, Chapter IV (Radio communications), Part B (Undertaking by Contracting Governments), Regulation 5 (Provision of radio Communication service) stipulates;

> "Each Contracting Government undertakes to make available, as it deems practical and necessary either individual or in cooperation with other Contracting Government, appropriate shore-based facilities for space and terrestrial radio communication services having due regard to the recommendations of the organization".

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 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 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 these completions.
- This Project should be planned as a top priority among Master Plans and Short Term Plans.

[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.

1.5.4. Expansion of GMDSS Coverage

(1) To establish Sea Area A2

[Urgent]

The following existing stations should be installed with MF DSC to cover major blind zones:

1st class ;	1 station	(Palembang)
2nd class ;	3 stations	(Sabang, Teluk Bayur and Banjarmasin)
3rd class ;	2 stations	(Samarinda and Bau-bau)
4th class ;	13 stations	(Tapaktuan, Natuna, Pangkal Balam, Bengkulu, Bima, Ende, Ketapang, Sampit, Poso, Toli-toli, Tual, Saumlaki and Agats)

Figure 1.5.4. shows the expansion coverage for Sea Area A2 by Urgent Project.

[Additional]

The following existing and new stations should be installed with MF DSC to cover small blind zones:

4th class (exist) ;	7stations	(Tg. Pandan, Kalabahi, Luwuk, Kuandang, Motorai, Amamapare and Sarmi)
(new) ;	3 stations	(Serang, Kangean and Lati)

Figure 1.5.5. shows the expansion coverage for Sea Area A2 by Additional Project.

(2) To establish Sea Area A1

[Urgent]

The following existing stations should be installed with VHF DSC to cover around main ports, and important navigation waters:

1st class ;	1 station	(Palembang)
2nd class ;	3 stations	(Sabang, Teluk Bayur and Banjarmasin)
3rd class ;	5 stations	(Tg. Uban, Jambi, Cirebon, Samarinda and Bau- bau)

4^{th} class ;	24 stations	(Tapaku Tuan, Lhokseumawe, Kuala Tanjung, Kuala Enok, Natuna, Pangkal Balam, Muntok, Bengkulu, Cigadang, Klianget, Meneng, Bima, Ende, Mumere, Ketapang, Sampit, Kumai, Batulicin, Pare-pare, Poso, Toli-toli, Tual, Saumlaki, and Agats)

Figure 1.5.6. shows the expansion coverage for Sea Area A1 by Urgent Project.

[Additional]

The following existing and new stations should be installed with VHF DSC to cover around major feeder ports and important navigation waters:

4^{th} class (exist):	12 stations	(Pekanbaru, Tg. Pandan, Tegal, Kalabahi, Palopo, Luwuk, Manado, Parigi, Kuandang, Morotai, Amamapare and Sarmi)
(new) :	3 stations	(Serang, Kangean and Lati)

Figure 1.5.7. shows the expansion coverage for Sea Area A1 by Additional Project.

1.5.5. 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 "IMORTANT" categories. However, message can be received by receivers of International NAVTEX without any modification, as the Indonesian alphabet is the same as English.

The present International NAVTEX stations (Jakarta, Makassar, Ambon and Jayapura) are used for the above purpose. The coverage of the National NAVTEX using 518 kHz should be referred to **Figure 1.5.3.**

[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. **Figure 1.5.8.** shows the coverage areas of National NAVTEX using 490 kHz by Additional Project.

All above implementations and its related stations are summarized in **Table 1.5.3.**

1.5.6. Implementation Schedule

Implementation Schedules for expansion and improvement of GMDSS and NAVTEX are shown in **Appendix 1.5.1.**

1.5.7. 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 1.5.4.**

Table 1.5.3. Expansion and Improvement Plan for GMDSS

Class		Name	A3	A2	A1	NAVTEX		Improvement				
			HF DSC	MF DSC	VHF DSC	nternationa	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			◎							
	14	Meneng (Banyuwangi)			◎							
	15	Serang (*)		○	○							
	16	Kangean (*)		○	○							
	17	Bima		◎	◎							
	18	Ende		◎	◎							

Remarks
* marked station is the new station, i.e., they were not listed up on the existing "221 stations" list.

Table 1.5.3. continuation

Class		Name	A3	A2	A1	NAVTEX		Improvement				
			HF DSC	MF DSC	VHF DSC	International	National	Separation	Relocation	VHF Area	E/G	Antenna
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

Table 1.5.4. 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

Figure 1.5.4. GMDSS Coverage Area (A2, Urgent)

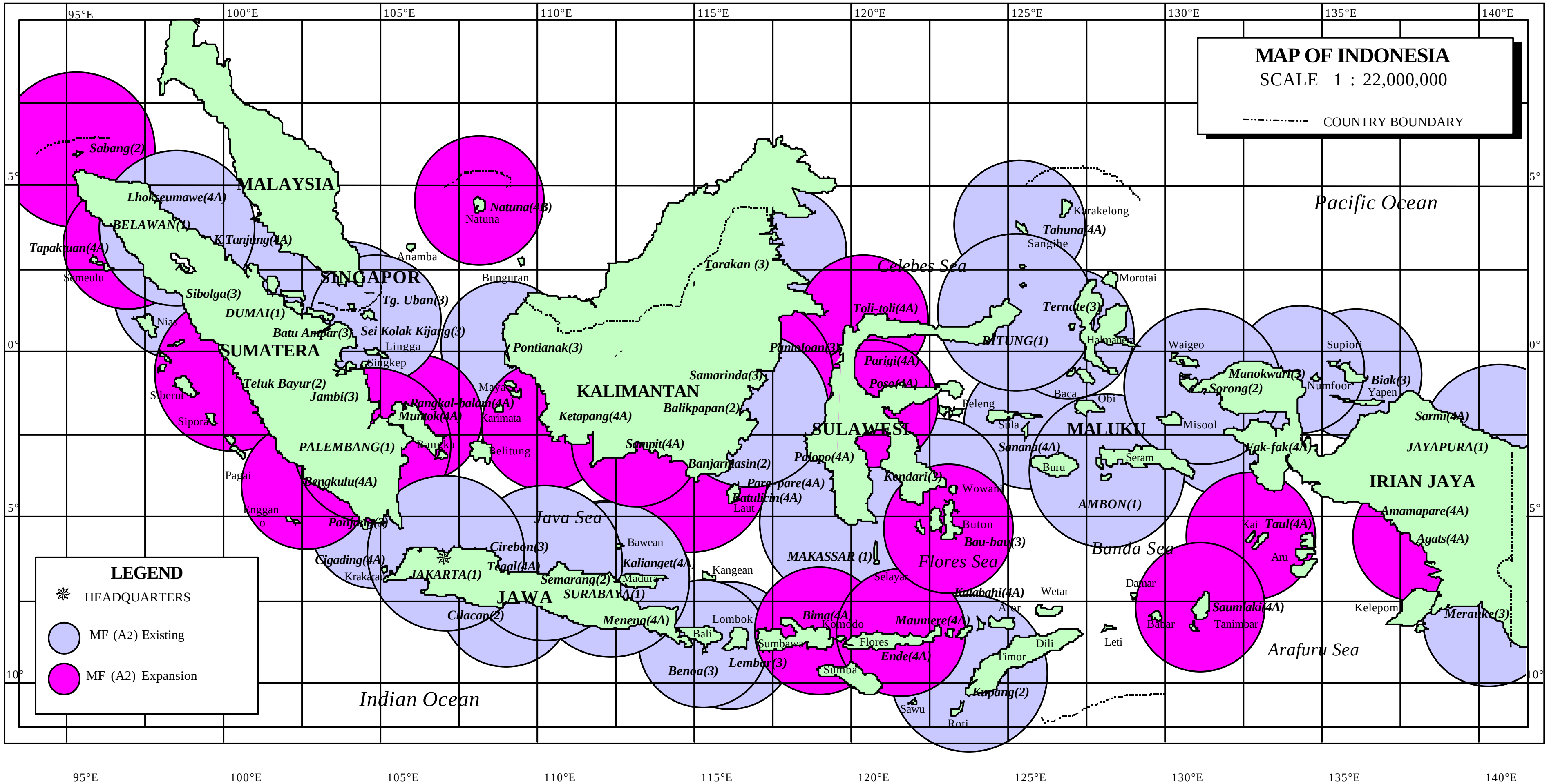


Figure 1.5.5. GMDSS Coverage Area (A2, Long Term)

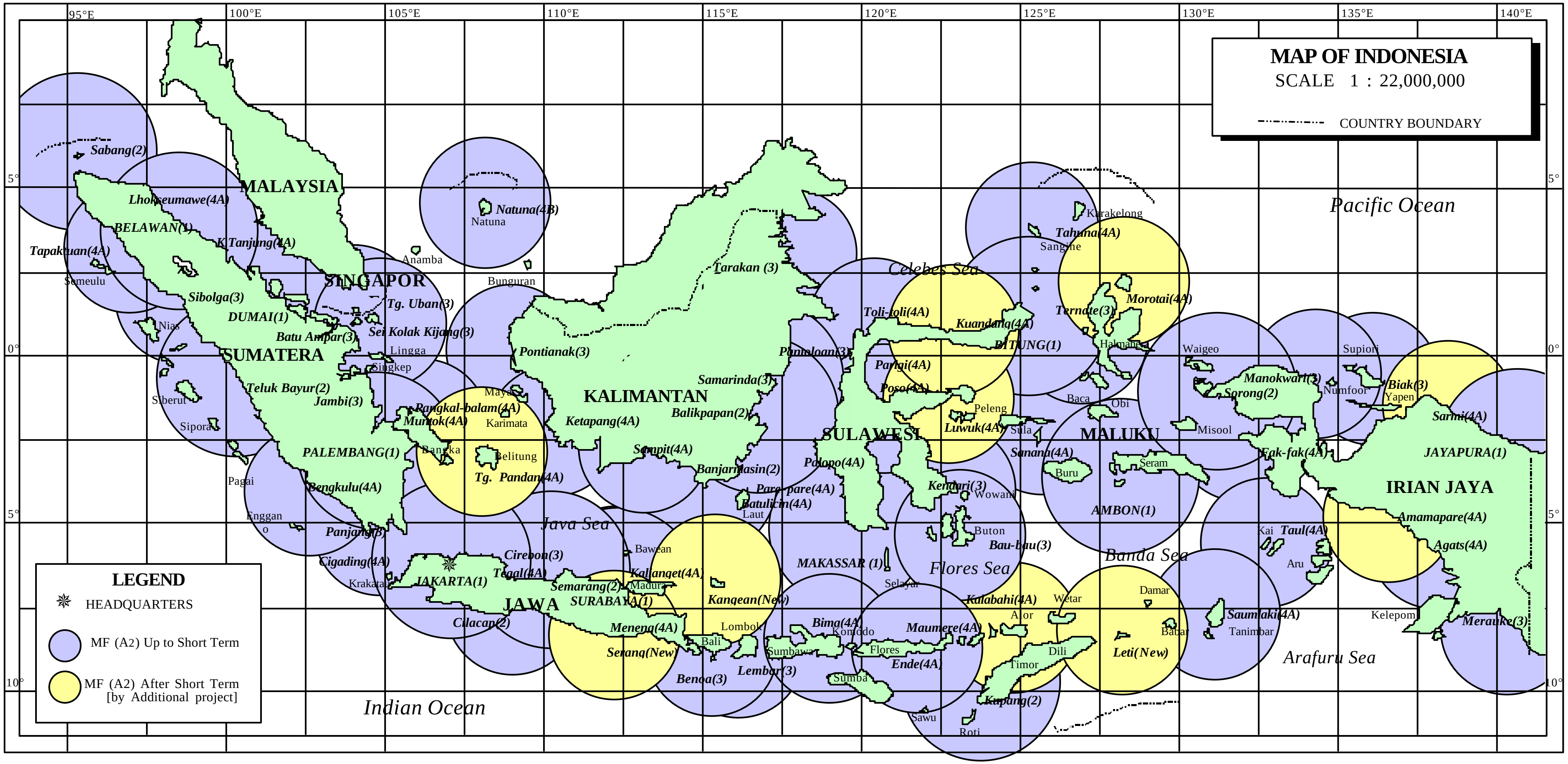


Figure 1.5.6. GMDSS Coverage Area (A1, Urgent)

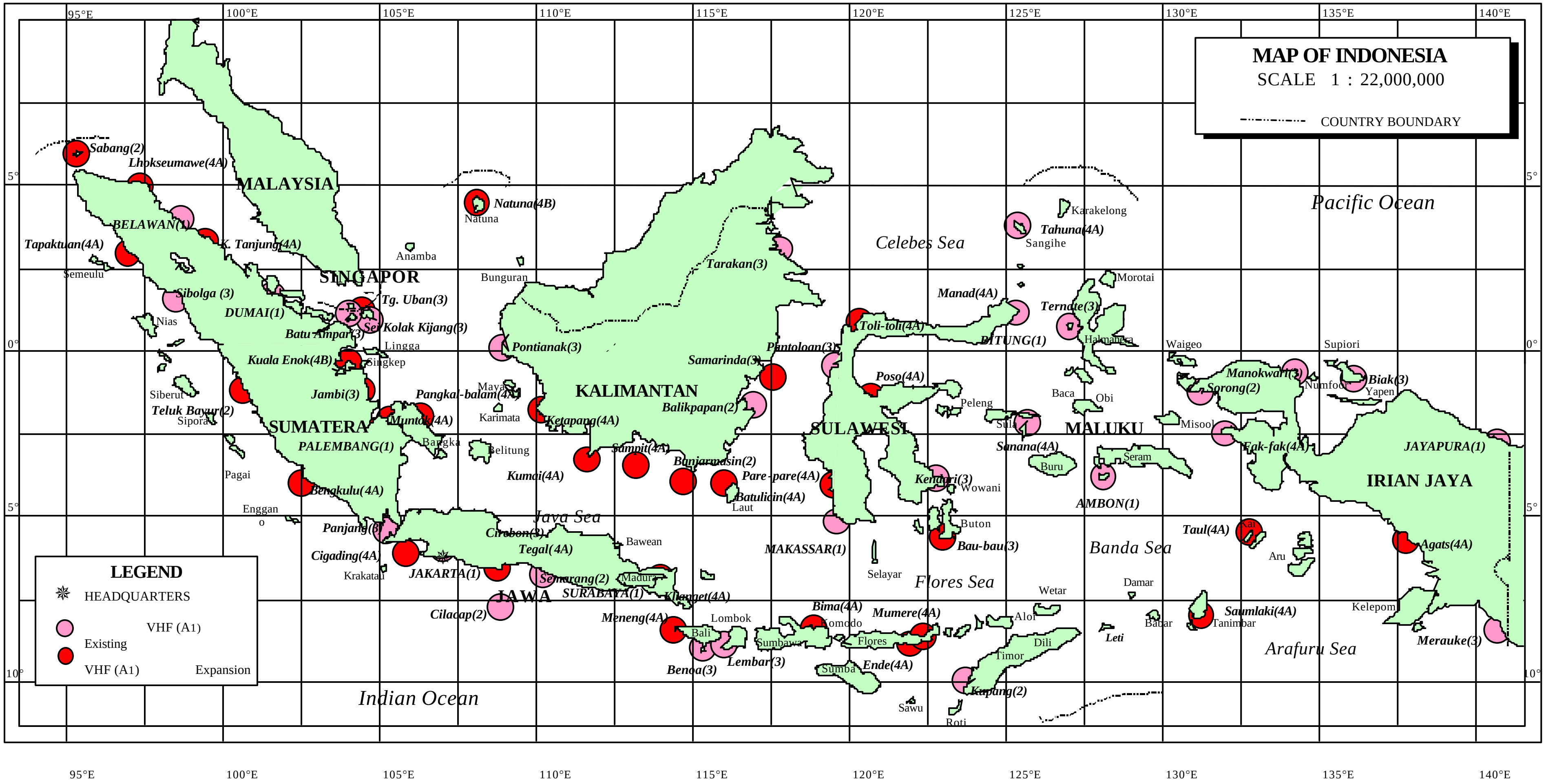


Figure 1.5.7. GMDSS Coverage Area (A1, Long Term)

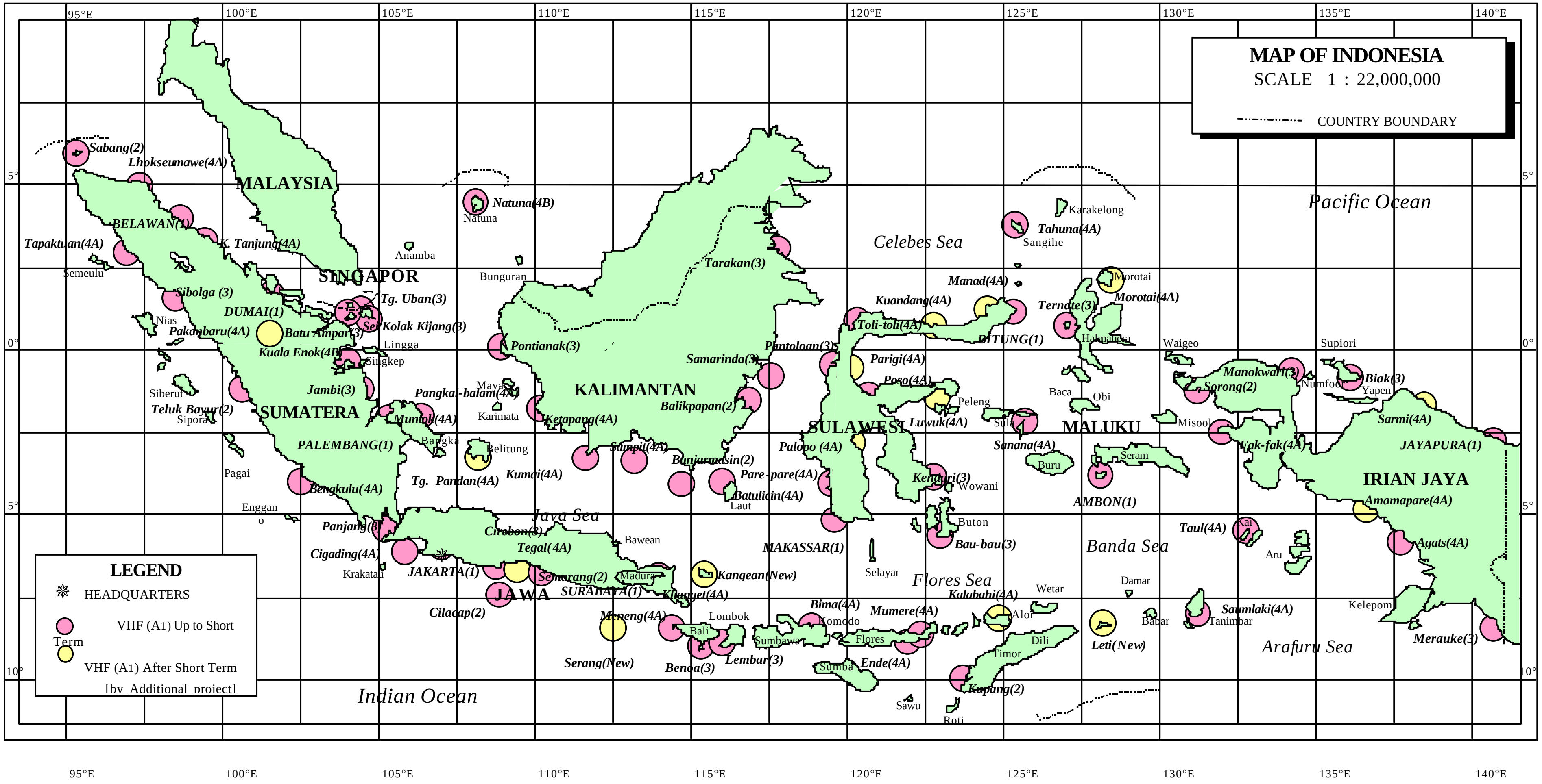
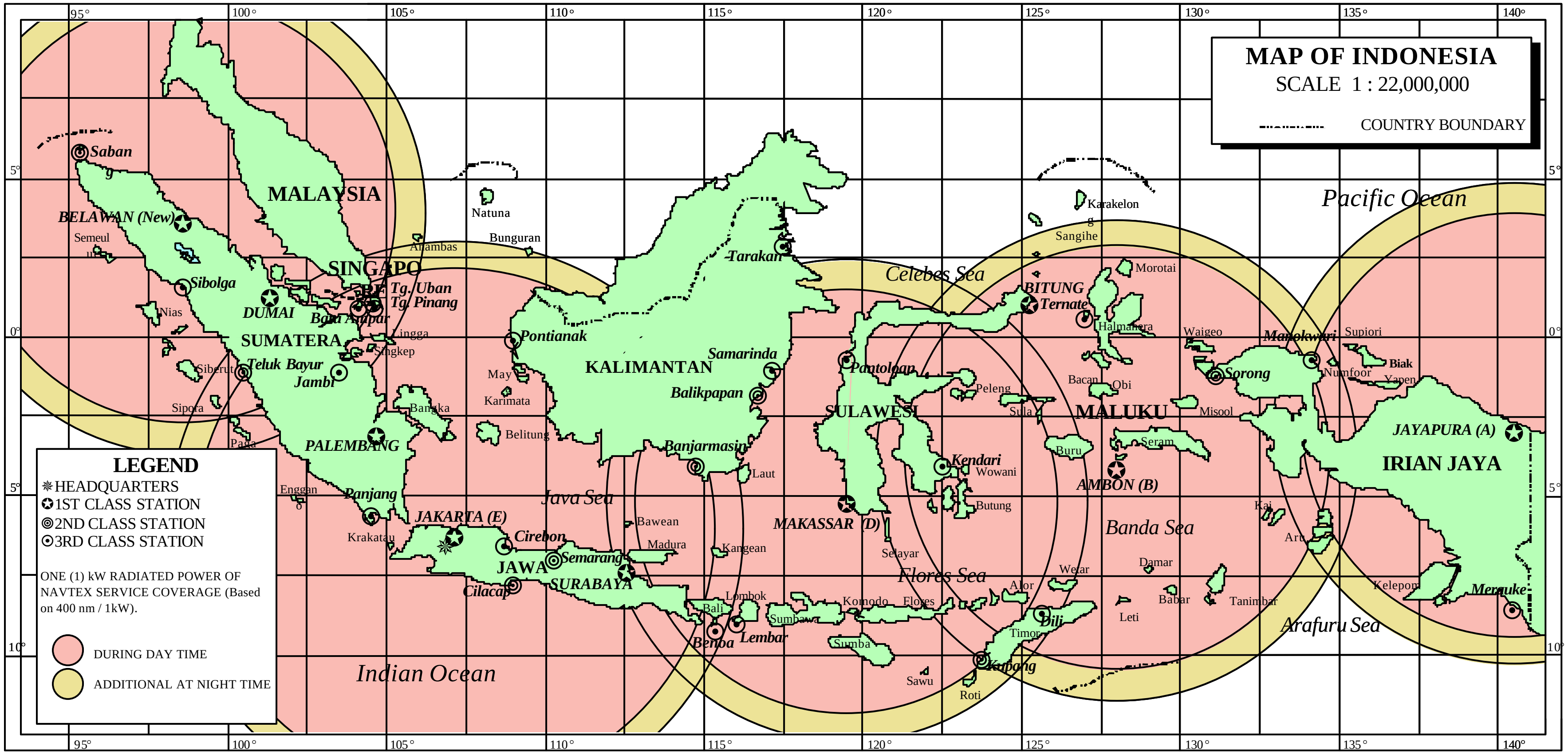


Figure 1.5.8. National NAVTEX Coverage Area



1.6. Indonesia Ship Reporting System

1.6.1. Introduction

"International Convention on Maritime Search and Rescue (SAR Convention) 1979" which has become effective since 1985, states in Chapter 6 (Ship Reporting Systems);

> "6.1.1 Parties should establish a ship reporting system for application within any search and rescue region for which they are responsible, where this is considered necessary to facilitate search and rescue operations and is deemed practicable." and
>
> "6.1.3 Ship Reporting System should provide up-to-date information on the movements of vessels in order, in the event of a distress incident:
>
> (1) To reduce the interval between the loss of contact with a vessel and the initiation of search and rescue operations in cases where no distress signal has been received;
> (2) To permit rapid determination of vessels which may be called upon to provide assistance;
> (3) To permit delineation of a search area of limited size in case the position of a vessel in distress is unknown or uncertain; and
> (4) To facilitate the provision of urgent medical assistance or advice to vessels not carrying a doctor."

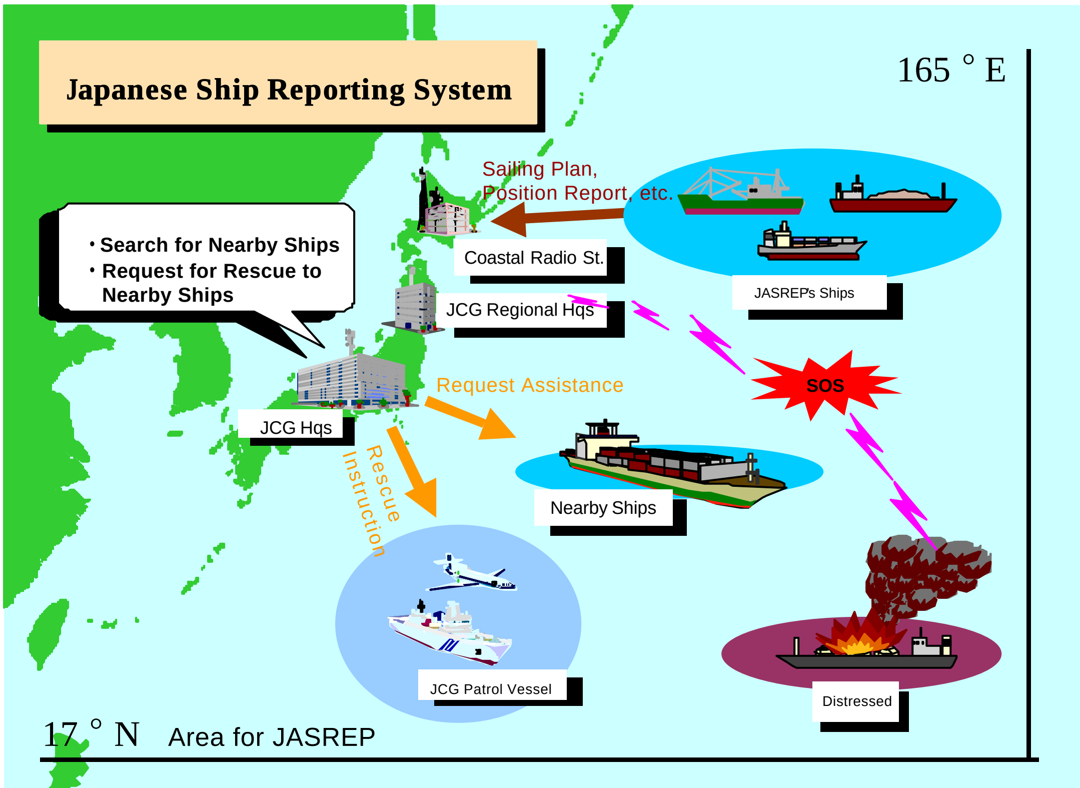
In consequence, a Ship Reporting System provides up-to-date information on the movements of vessels in order to give a quick and maximum assistance by participating vessels to a vessel which may be in distress, and in order to facilitate a quick SAR operation in case of missing of a participating vessel.

Figure 1.6.1. illustrates the concept of a Ship Reporting System and **Figure 1.6.2.** shows the reporting manners of the System by an example of Japanese Ship Reporting System (JASREP).

As **Figure 1.6.3.** shows a typical rescue flow in distress at sea, a Ship Reporting System plays an important role in maritime search and rescue in conjunction with distress and safety communication system by GMDSS.

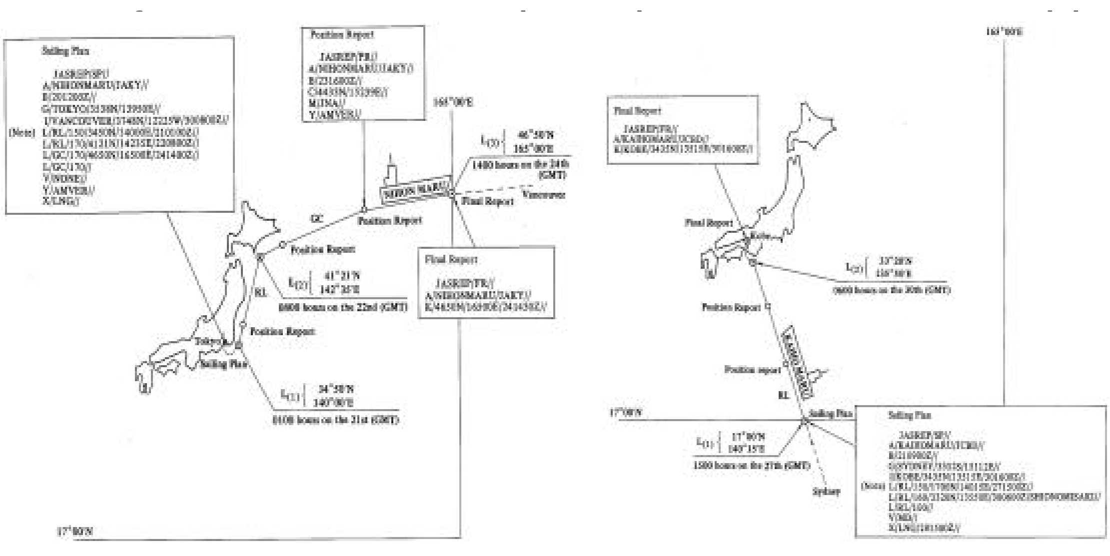
Ship reporting systems are in these days used to provide data for many purposes, not only search and rescue but also preventing marine pollution, countermeasures for crimes at sea, etc.

Figure 1.6.1. Concept of Ship Reporting System



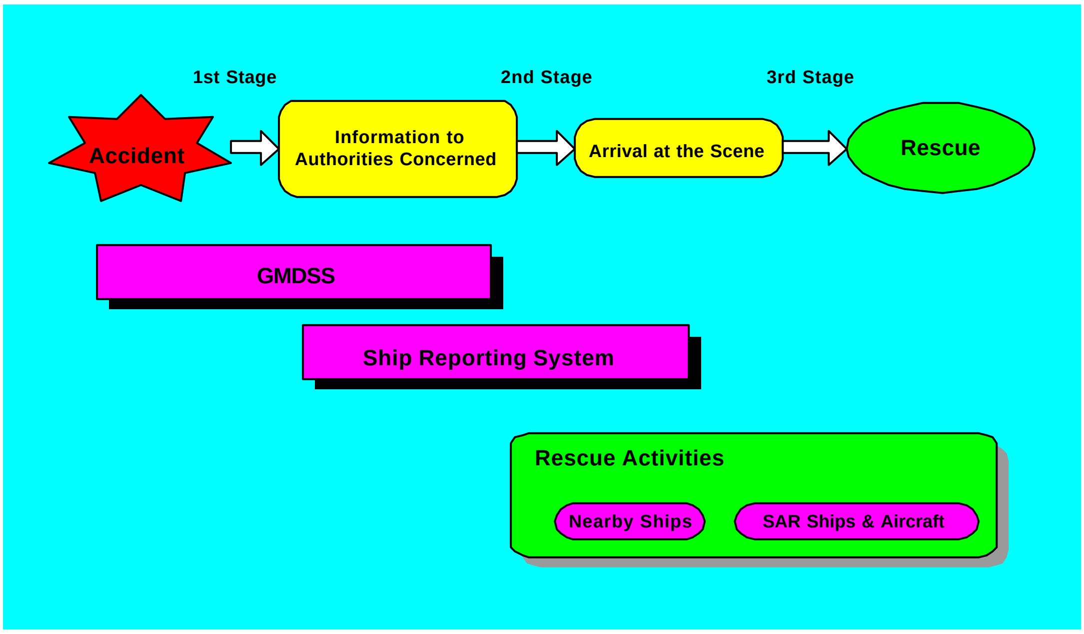
Source: JCG

Figure 1.6.2. Ship Reporting Manner (Example in JASREP)



Source: GOJ

Figure 1.6.3. Typical Rescue Flow in Distress at Sea



Under these circumstances, International Maritime Organization (IMO) has adopted Resolution A.851 (20) "General Principles for Ship Reporting Systems and Ship Reporting Requirements, including Guidelines for Reporting Incidents involving Dangerous Goods, Harmful Substances and/or Marine Pollutants" in 1997.

The Resolution A.851 (20) specifies;
(1) Types of Reports including General Report and Special Report,
(2) Standard Reporting Format and Procedures,
(3) Guidelines for Detailed Reporting Requirements, etc.

Appendix 1.6.1. shows Japanese Government is encouraging for expanded ship reporting after the simultaneous multi-terrorism in the Unite States on 11 September 2001, considering that there will be threat to ships such as terrorism and piracies.

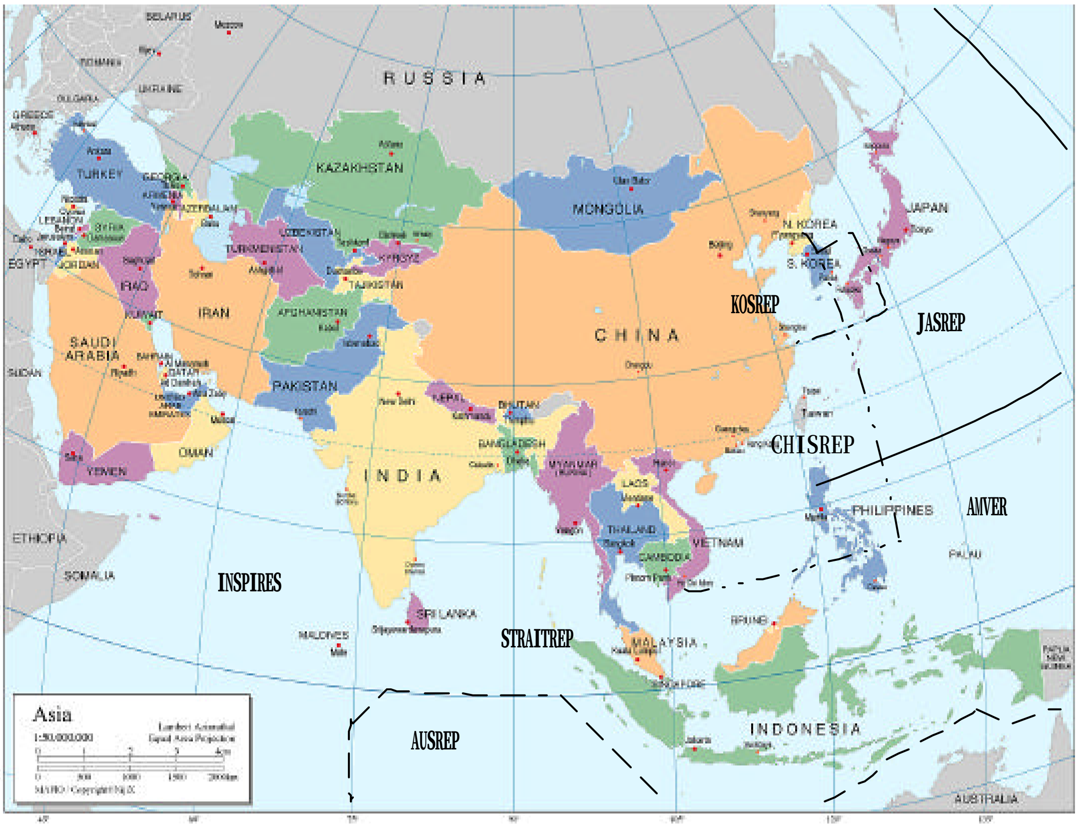
1.6.2. Expansion of Ship Reporting System in Asia-Pacific

AMVER (Automated Mutual-assistance VEssel Rescue system), the Ship Reporting System of the United States has been operated since 1958, which has made significant achievements in saving human lives making history in this field.

Thereafter, the System has been established in many countries, for Asia-Pacific regions, AUSREP (Australia), JASREP (Japan), INSPIRES (India), STRAITREP (The Strait of Malacca and Singapore), KOSREP (Korea) and CHISREP (China), have started and contributed greatly to maritime safety.

Service area of each Ship Reporting System in Asia-Pacific region is shown in **Figure 1.6.4**. and the outline of each System is shown in **Table 1.6.1.**

Figure 1.6.4. Ship Reporting Systems in Asia -Pacific Region



On the other hand, In 1999, the Experts Meeting on Ship Reporting Systems hosted by Japan Coast Guard was held in Tokyo inviting the participants from Asia-Pacific region countries: Australia, China, Indonesia, Korea, Malaysia, Philippines, Russia, Singapore, United States and Japan.

Table 1.6.1. Outline of Ship Reporting System of Each Country

	JASREP	AMVER	KOSREP	AUSREP	CHISREP
Area to be covered	North of 17°N West of 165°E	All over the World.	North of 30°N South of 40°N West of 135°E	Refer to the figure.	North of 9°N West of 130°E
Participating ships	All ships within the Area. (Voluntary)	Ships of 1000GT or over which navigates for 24 hours or more.	Passenger ships engaged in international navigation; Cargo ships of 300GT or over.	Mandatory for merchant ships of Australian flag and foreign ships navigating between ports of Australia: Other ships are recommended to participate while in the AUSREP Area.	Chinese ships of 300GT or over engaged in international navigation: Chinese ships of 1600GT or over: Foreign ships departing from and/or entering into Chinese ports: Ships participating voluntarily.
Type of report	Sailing plan Position report Deviation report Final report	Sailing plan Position report Deviation report Arrival report	Sailing plan Position report Deviation report Final report	Sailing plan Position report Deviation report Final report	Sailing plan Position report Deviation report Final report. and Dangerous goods. Harmful substances and Marine pollutant reports
Reporting interval	24 hours	Within 24 hours after departure, and thereafter every 48 hours	12 hours	24 hours	24 hours
Implementing authority	Japan Coast Guard	USCG	National Maritime Police Agency	Australian Maritime Safety Authority	Chinese Maritime safety Administration
Remarks	Linking with AMVER. Since 1985.	Linking with JASREP and AUSREP. Since 1958.	Since 1999.	Linking with AMVER. Since 1972.	Since 2000.

1.6.3. 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.

1.6.4. Concept of Indonesia Ship Reporting System

Proposed framework of Indonesia Ship Reporting System is as follows:

(1) System's Name

Indonesia Ship Reporting System is tentatively called INDOSREP.

(2) Area to be covered

Search and Rescue Region (SRR) will be suggested as a reporting area in accordance with SAR Convention. **Figure 1.6.5.** shows the area of the Indonesian SRR.

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)	for departure
② Position report (PR)	with necessary interval
③ Deviation report (DR)	as needed
④ Final report (FR)	on arrival at destination

Figure 1.6.5. Area of Ship Reporting System in Indonesia (for Example, by SRR)

Special Reports;

① Dangerous goods report (DG) — when an incident takes place

② Harmful substances report (HS) — when an incident takes place

③ Marine pollutants report (MP) — in the case of loss or likely loss overboard of harmful substances

(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.

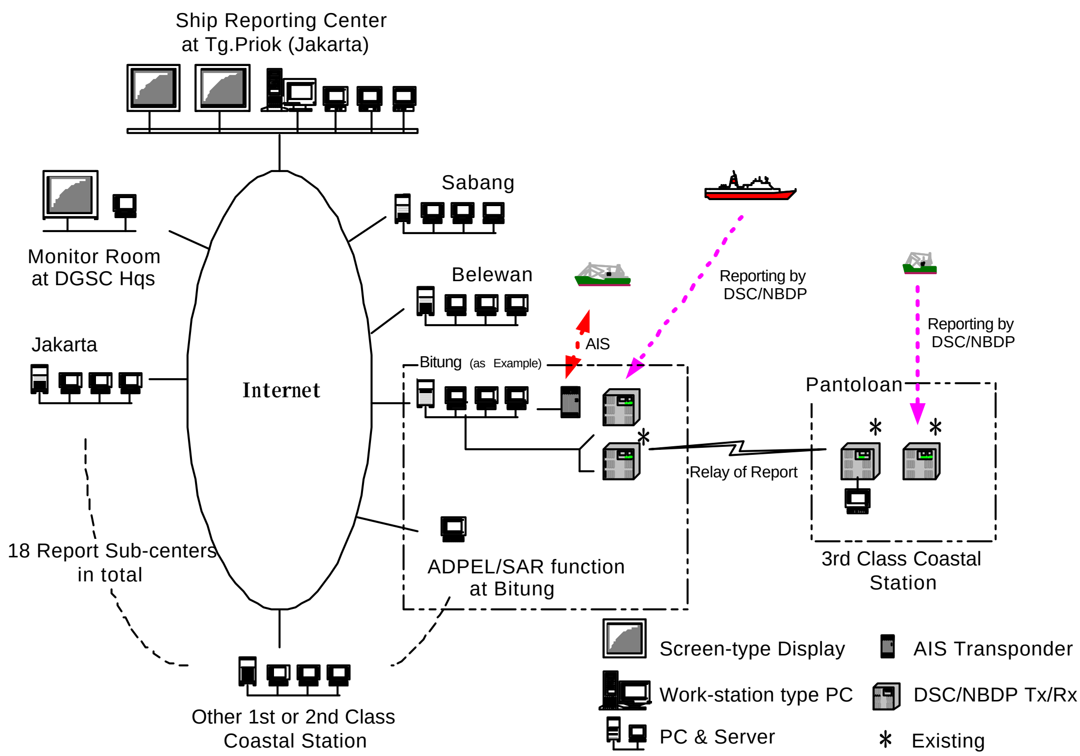
(6) Implementing Authority

Director General of Sea Communication, Ministry of Communication

1.6.5. System Composition

System configuration of INDOSREP is shown in **Figure 1.6.6.**

Figure 1.6.6. System Configuration of INDOSREP



Type of station and its given function as the node of INDOSREP are mentioned below.

(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.

(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 sends the data to ADPEL and other SAR related organizations as needed.

(3) Ship Reporting Center

Ship Reporting Center (Center) will be set up at Jakarta, Tg. Priok. The 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 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 1.6.7. and Table 1.6.2. show the project sites for INDOSREP.

Figure 1.6.7. Project Sites of Ship Reporting System

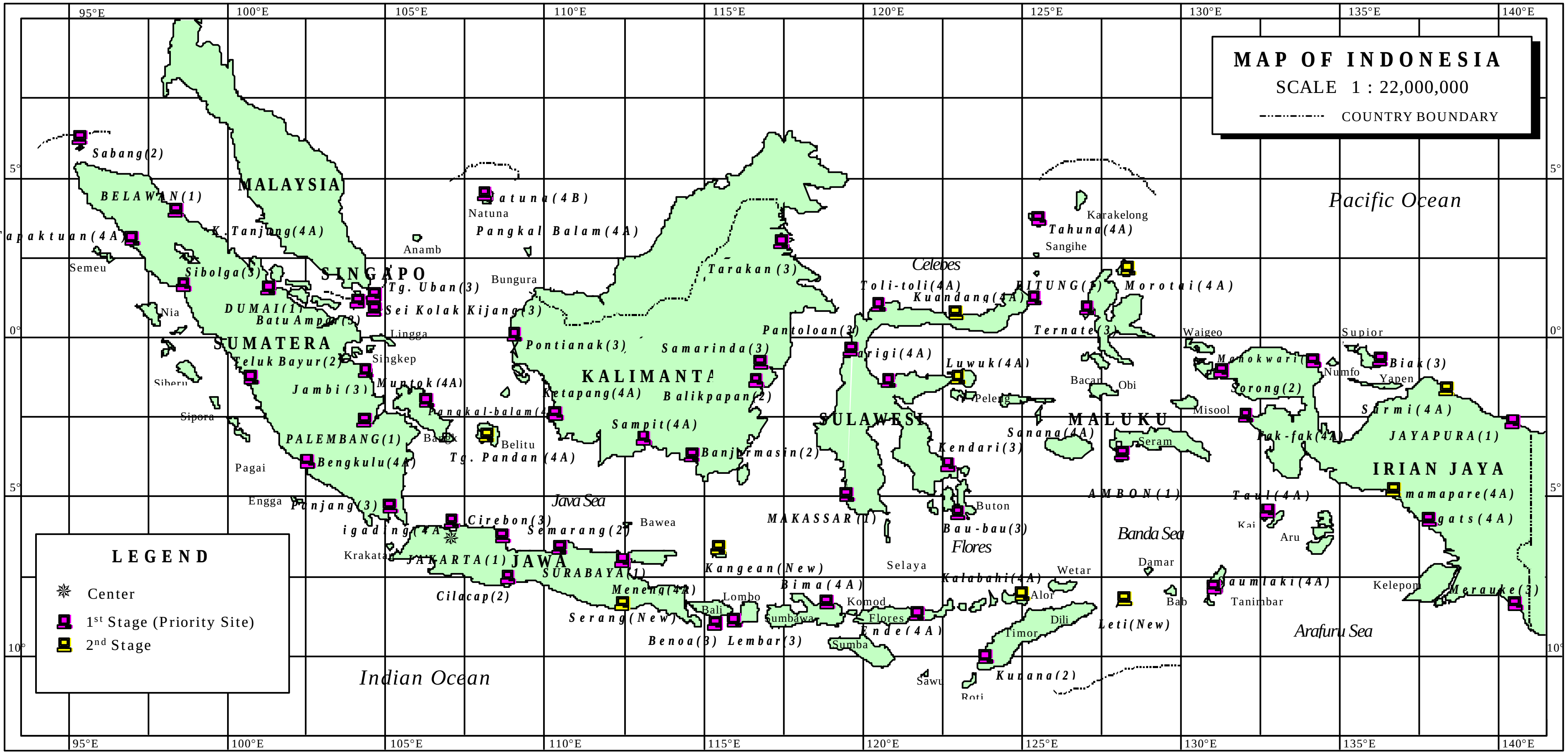


Table 1.6.2. Establishment and Expansion Plan for Ship Reporting System

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 (*)					○	○		
	17	Bima					◎	○		
	18	Ende					◎	○		
	19	Maumere								
	20	Kalabahi					○	○		
	21	Lati (*)					○	○		
	22	Ketapang					◎	○		
	23	Sampit					◎	○		
	24	Kumai								
	25	Batulicin								

Table 1.6.2. continuation

Class		Name	Center	Sub-center	Controlling & Monitoring	(A3) HF DSC/NBDP	(A2) MF DSC/NBDP	(A1) VHF AIS	HF Long-range AIS	INMARSAT AIS
IV	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)

1.6.6. Implementation Schedule

Implementation schedule of INDOSREP is shown in **Appendix 1.5.1**

1.6.7. Cost Estimate

Implementation costs for establishment and expansion of INDOSREP are estimated as shown in **Table 1.6.3.**

Table 1.6.3. 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

1.7. Telecommunications System

1.7.1. Up-grading of Internal Communication Network

(1) DGSC's telecommunication link

(a) Links between Jakarta and district coastal stations

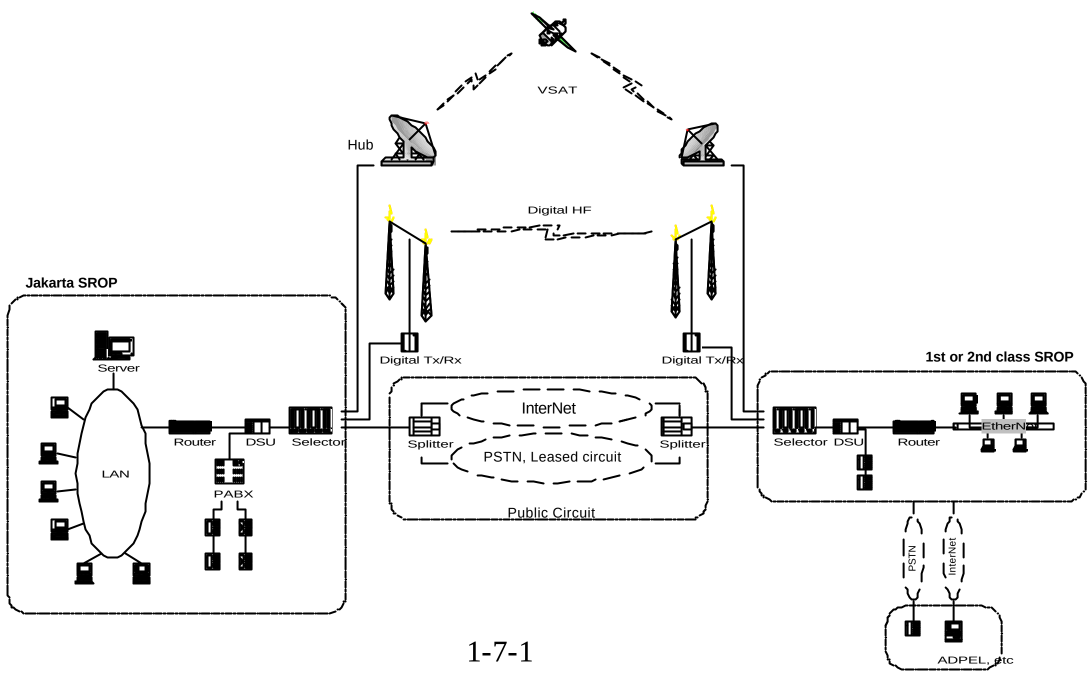
Existing communication means between DGSC's headquarters/Jakarta coastal radio station and district coastal stations is analog HF system. This conventional analog HF system can deliver low speed (up to 100 bps) telex signal and SSB voice signal only.

Quality of the conventional HF system depends on condition of ionosphere of which density and height vary from hour to hour and season to season. Then even if an operator tries to select most suitable frequency at the moment, keeping the quality is sometimes very difficult, and connection itself too.

Recent development in the field of information and telecommunication is remarkable. The usage cost of public circuits is decreasing because of the development of internet, VSAT, large capacity system of transmission means and competition among the services providers. Digital HF system, using an ionosphere analysis processor and an automatic link establishment (i.e., automatic frequency selection) function, is also developing. This system enables the communication between coastal stations to be more reliable and speedier (approximately 2,400 bps).

Figure 1.7.1. shows possible transmission means to connect the coastal stations and local offices in the next era of DGSC.

Figure 1.7.1. A Concept of Internal Telecom System in the Next Era



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.

Upon planning upgrading of network, the following matters should be taken into consideration:

① DGSC headquarters moved to present 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. The Center will be established at Karijabad.

② 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.

The above upgraded network will be used also for data transmission on land for Ship Reporting System.

(b)Links among local offices

DGSC's local offices (DISVAV, KANWIL, ADPEL, ARMADA, etc.) are connected by UHF, VHF or Digital Radio Concentrator System (DRCS). And in the offices, terminal equipment for the linking and HF/VHF console for distant/ship communication are installed.

Those equipments have been furnished by SAR telecommunication project in 1991/1992. However most of the equipments have malfunctioned due to operation and maintenance problems.

Basically, there are no trained telecommunication operator and/or engineer in such local office. More simple communication means in operation are required.

Recent IT provides a simple and low cost system to the market as already described. This technology is recommended to apply to DGSC's local network.

An idea applying IT equipment to the local network is shown in **Figure 1.7.1.** too. The area where a large number of offices exist will be connected by Local Area Network (LAN), and small number offices' area by Ether-network.

(2) Comparison of transmission means

Table 1.7.1.shows the features of the each transmission mean.

Table 1.7.1.Features of Each Transmission Mean

		Cost		Nationwide	Quality	Electrical	Security
		Initial	Running	Availability		Reliability	
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.

Detail of cost comparison is shown in **Table 1.7.2.**

Table 1.7.2. Cost Comparison of Transmission Means for Internal Telecom System

Provider or System Name		Capacity or Speed	Cost		Remarks
			Initial	Running	
Public Circuit	Leased Circuit				
	PT. Telkom	Tel line (3.1kHz)	-	26,000-52,000 $/month	500km or more
	Internet				
	IndoSat Net	24-56kbps	-	0.4 $/hour	There is a possibility to become
				120 $/month-fixed	100 $/month by 8Mbps ADSL.
	Telkomnet	24-36kbps	-	0.9 $/hour, 660 $/month	
Satellite	INMARSAT				
	Inmarsat Mini-M	Tel, Fax, Data	15,000 $/site	3.1 $/min, 136,152 $/month	in Pacific ocean
	Inmarsat B	Tel, Fax, Telex, 64kbps	45,000 $/site	6.7 $/min, 294,264 $/month	in Pacific ocean
	Indonesian Domestic				
	Telkom	32kbps Lease	-	5,100 $/month	2 circuits lease
		64kbps Lease	-	6,800 $/month	2 circuits lease
DGSC's Own Circuit	Analog HF	Tel, Telex	430,000 $/site	-	1Tx, 1Rx, Control system
	Digital HF	2.4kbps	550,000 $/site	-	1Tx, 2Rx, Control system Tx/Rx separate type may be realized around the year 2006.

As shown in the cost comparison table, public (PT. Telkom) leased circuit is extremely expensive. This circuit will be open to the market in the near future, then cost competition will be held between providers. However much cost reduction will not be expectable.

Usually satellite system is used on-demand basis. Full time occupancy makes high cost. Therefore when applying the satellite, communication method i.e., operation time between the coast stations shall be deeply considered and sometimes be limited by traffic of the station (1st /2nd class or 3rd/4th class).

Internet services have already been deployed over the major cities in Indonesia. The services will be expanded to small cities and towns rapidly. And so many government communications are using this internet including the information system against piracy and armed robbery of DGSC. The services/system is expected to give higher speed but lower cost.

(3) Improvement stages

Taking into account the above features and cost of transmission means, 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 1.7.3.**

Table 1.7.3 .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

At the 1st stage, Indonesia Ship Reporting System will be started. The data will be transferred by internet because the real time AIS data are handled by 1st or 2nd class coast station only.

At the 2nd stage, 3rd class's AIS data and long range AIS data will be transferred to 1st or 2nd class station and Jakarta coast station. In this stage, VSAT and/or Digital HF system shall be introduced in comparing with the leased cost of that era.

At the 3rd stage, 3rd and 4th class stations will be integrated to 1st or 2nd class station. To achieve the integration, higher speed and more reliable transmission means are required, and this will be realized through a high speed internet or VSAT system.

(4) Implementation schedule

The implementation schedule is shown in **Appendix 1.5.1.**

(5) Cost estimate

Implementation costs from the 1st stage to the 3rd stage are estimated in **Table 1.7.4.**

Table 1.7.4. Improvement Cost for Internal Telecom System

Unit: Thousand US$

1st Stage	-
2nd Stage	3,100
3rd Stage	1,800
Total	4,900

(6) Remarks

[Cancellation of Feasibility Study for Internal Communication Network]

At the meeting on Interim Report, Up-grading of Internal Communication Network was selected as a Priority Project from the following reasons:

(a) The conventional HF system is too unstable to meet the recent DGSC's requirements for advanced information.

(b) DGSC headquarters moved to present 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.

(c) Planned Indonesia Ship Reporting system requires up-grading telecommunication system for data transmissions.

(d) The countermeasures against piracy and armed robbery requires the prompt and simple telecommunication system between DGSC headquarters and district offices.

(e) 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.

However, as mentioned above, 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 Internal Communication Network, and DGSC agreed it.

1.7.2. Integration of coastal Radio Stations

(1) General

DGSC has deployed 221 coastal radio stations throughout Indonesia with the following classification:

1st class	:	9 stations
2nd class	:	8 stations
3rd class	:	19 stations
4th class	:	185 stations

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

The management of the 3rd or 4th class station is done under the supervision of the 1st or 2nd class station in each DISNAV area.

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 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.

At present, number of DISNAV are 24, and number of the 1st and 2nd class stations are 17, so seven (7) 3rd class stations should be up-graded to the 1st or 2nd class stations prior to the integration.

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 **Appendix 1.5.1.**

(4) Cost Estimate

Implementation costs for the integration of 3rd and 4th class stations are estimated as **US$ 30,000,000**.

1.7.3. 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 be 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. Numbers of ships are as follows:

	GAMAT Ships	NAVIGASI Ships
Class Ⅰ	0	24
Class Ⅱ	9	10
Class Ⅲ	14	41
Class Ⅳ	38	5
Class Ⅴ	68	0

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 equipment.

(3) Implementation schedule

The implementation schedule is shown in **Appendix 1.5.1.**

(4) Cost estimate

Up-grading costs for ship's telecommunication equipment are estimated in **Table 1.7.5.**

Table 1.7.5. Up-grading Cost for Ship's Telecom Equipment

Unit: Thousand US$

1st Stage	8,600
2nd Stage	9,800
Total	18,400

1.7.4. Replacement and Improvement of aged Equipment/Facilities

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.

(1) 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

Although Teluk Bayur (2nd) and Benoa (3rd) stations are located at key spots for maritime safety and has many links with other lower class coast stations, both stations have been operated at a single site where the transmitters and receivers are collocated.

These stations should be separated into transmitting and receiving sites. In addition, Benoa station should be classified as the 2nd class station.

(b) Improvement of environment for coast stations

In Surabaya (1st) and Makassar (1st) 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 and Makassar stations are too limited in space to ensure the antenna system of the 1st class station.

Both for Surabaya and Makassar stations, the transmitting (Tx) station should be moved to new site, and new receiving (Rx) station should occupy the existing TX station site.

(c) Improvement of VHF coverage

Dumai station (1st class) cannot communicate with the vessels passing the Strait of Malacca by VHF because of a big Rupat island exists in front of Dumai port.

Samarinda station (3rd class) is located about 30 km upriver from the sea and VHF radio wave cannot reach to the coastal line.

These VHF coverages of Dumai and Samarinda coast stations should be expanded.

(d) Improvement of engine-generators

Most engine-generators of the 1st and 2nd class coast stations are very old and no spare parts are available at the station or market.

A set of engine-generator with automatic start/stop function should be provided in each of Tx and Rx stations at the 1st and 2nd class stations in substitute for old ones.

(e) Replacement of old antennas

Most antennas at the 1st and 2nd class coast stations have been installed in the old days, and such antennas should be replaced as soon as possible.

(2) 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.

(3) 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 **Appendix 1.5.1.**

(4) Cost estimate

Costs for replacement and improvement of aged equipment/facilities are estimated in **Table 1.7.6.**

Table 1.7.6. Cost for Improvement of Equipment

Unit: Thousand US$

1st Stage	17,787
2nd Stage	20,000
3rd Stage	20,000
Total	57,787

1.8. 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 1.8.1.**

The location map of aids to navigation field on the Master Plans up to year 2020 is shown in **Figure 1.8.1.** and that of telecommunications system is shown in **Figure 1.8.2.**

Table 1.8.1. 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

Figure 1.8.1. Location Map of Aids to Navigation Field on Master Plans up to Year 2020

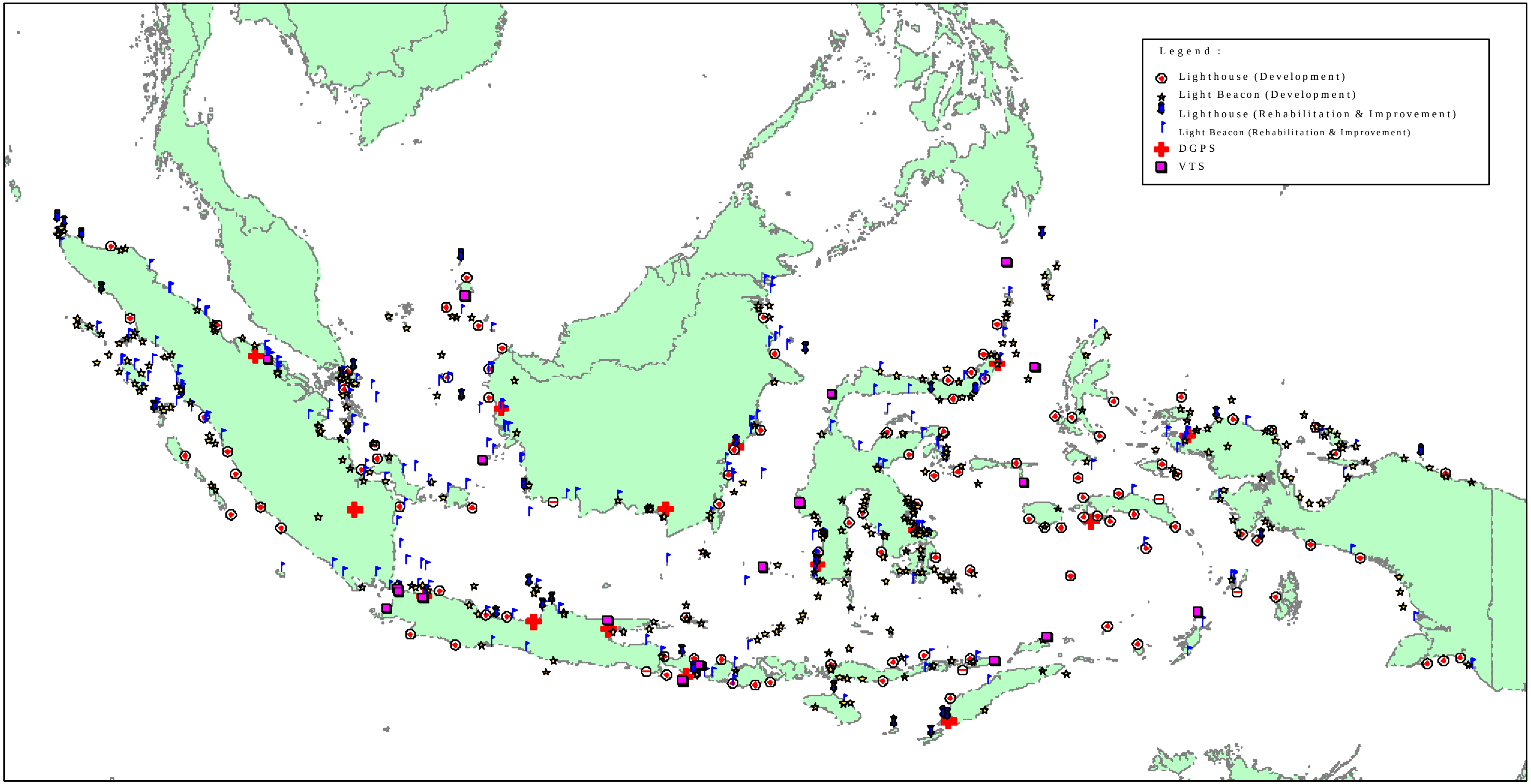
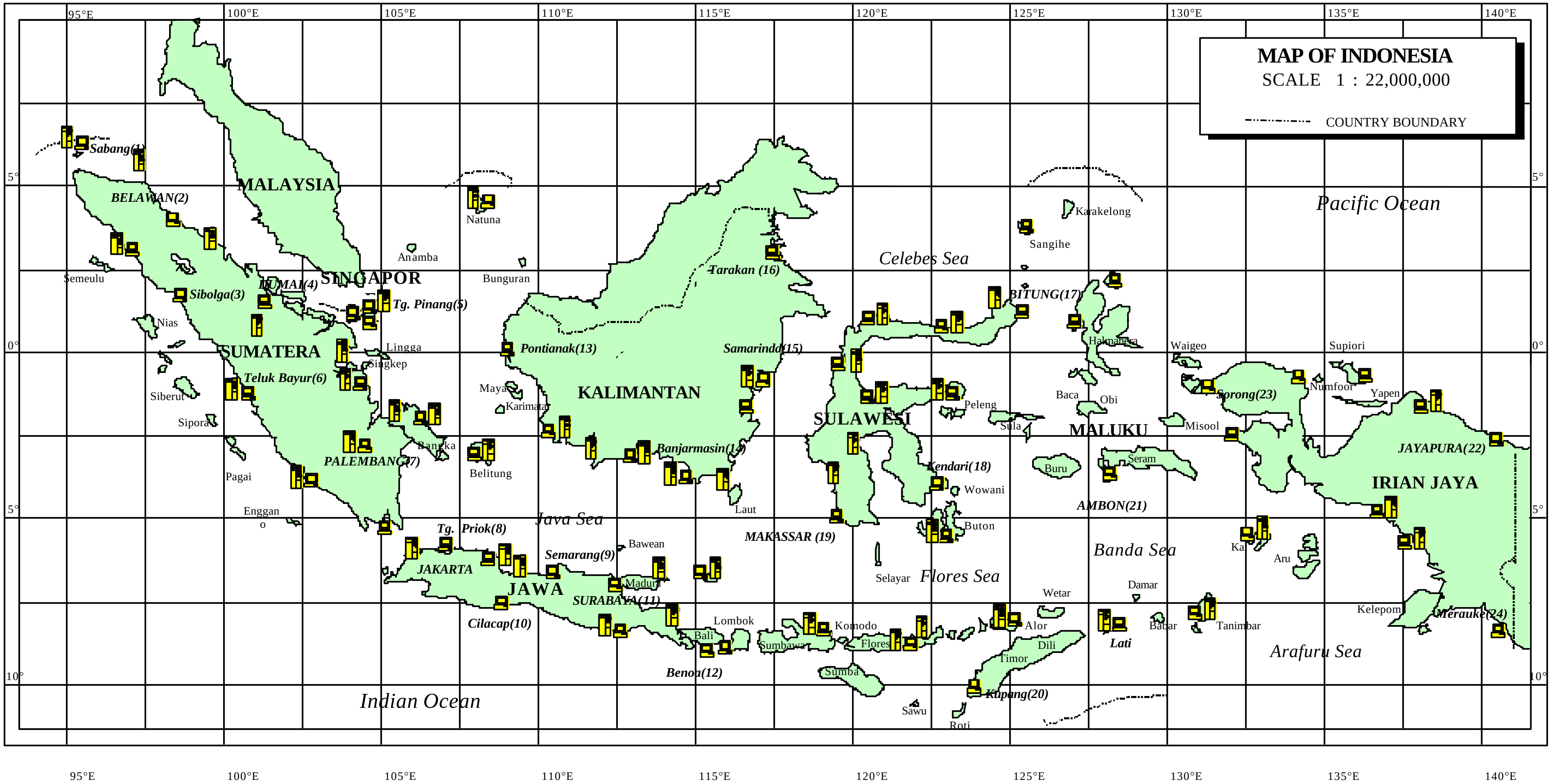


Figure 1.8.2. Location Map of Telecommunication System Field on Proposed Priority



LEGEND

GMDSS

Ship Reporting System

Name of city/town in map and the number in () shows the location of DISNAV and its number.

CHAPTER 2.

SHORT TERM PLANS UP TO YEAR 2007

CHPTER 2.
SHORT TERM PLANS UP TO YEAR 2007

2.1. Visual Aids to Navigation

The sites in Short-term Plan for visual aids to navigation is selected from Master Plan. Total number of each visual aids to navigation is shown in **Table 2.1.1**.

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 2.1.1 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 following aspect in Master plan;

- Operation status,
- Lantern condition,
- Power supply conditions,
- Structure condition.

Lighthouses and Light beacons for rehabilitation and improvement are shown in **Appendix 1.1.1** (Short-term Plan is the same as Master Plan) and **Appendix 2.1.1** respectively as the Short-term Plan.

The locations of lighthouses and light beacons for rehabilitation and improvement are shown in **Figure 2.1.1** and **Figure 2.1.2**

Light buoys for rehabilitation are the same as Master Plan, that is all buoys were included in the Short-term plan, whose bodies were damaged and shown in **Appendix 1.1.3.**

(2) Development Plan

Lighthouses and Light beacons for short plan were selected considering following aspect in Master Plan

- Sea lane
- Traffic route
- Dangers on route
- Marine casualty

Criteria of selection is the condition shown in **Table 2.1.2** and the priority of development of lighthouse and light beacon shown in **Appendix 1.1.4** and **Appendix 1.1.5.**

Light buoy for short plan is allocated to main ports in SISTRANAS.

Table 2.1.2. Condition of Short Plan for Lighthouse and Light Beacons

Condition of Short Term Plan		
Lighthouse		
1	First	Total score is more than 30
2	Second 1	Item of Sea-lane is scored more than 2.5 points
2	Second 2	Item of Traffic route is scored 10 points and Item of Dangers is scored 10 points or Item of Marine casualty is scored 10 points
Light beacon		
1	First	Total score is more than 30
2	Second 1	Item of Sea-lane is scored more than 2.5 points
2	Second 2	Item of Dangers is scored 10points or Item of Marine casualty is scored 10points or Traffic route is scored 10points

Lighthouse to be developed in Short-term Plan is shown in **Appendix 2.1.2.** And light beacon to be developed for Short-term Plan is shown in **Appendix 2.1.3.**

The locations of lighthouses and light beacons for development in Short-term Plan are shown in **Figure 2.1.3** and **Figure 2.1.4.** respectively.

(3) Implementation Schedule

Implementation schedule of Short-term Plan is shown in **Table 2.1.3.**

Table 2.1.3. 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 2.1.4.**

There are included cost of rehabilitation for visual aids to navigation.

Table 2.1.4 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

Figure 2.1.1. Location Map of Rehabilitation and Improvement of Lighthouses in Short Term Plan

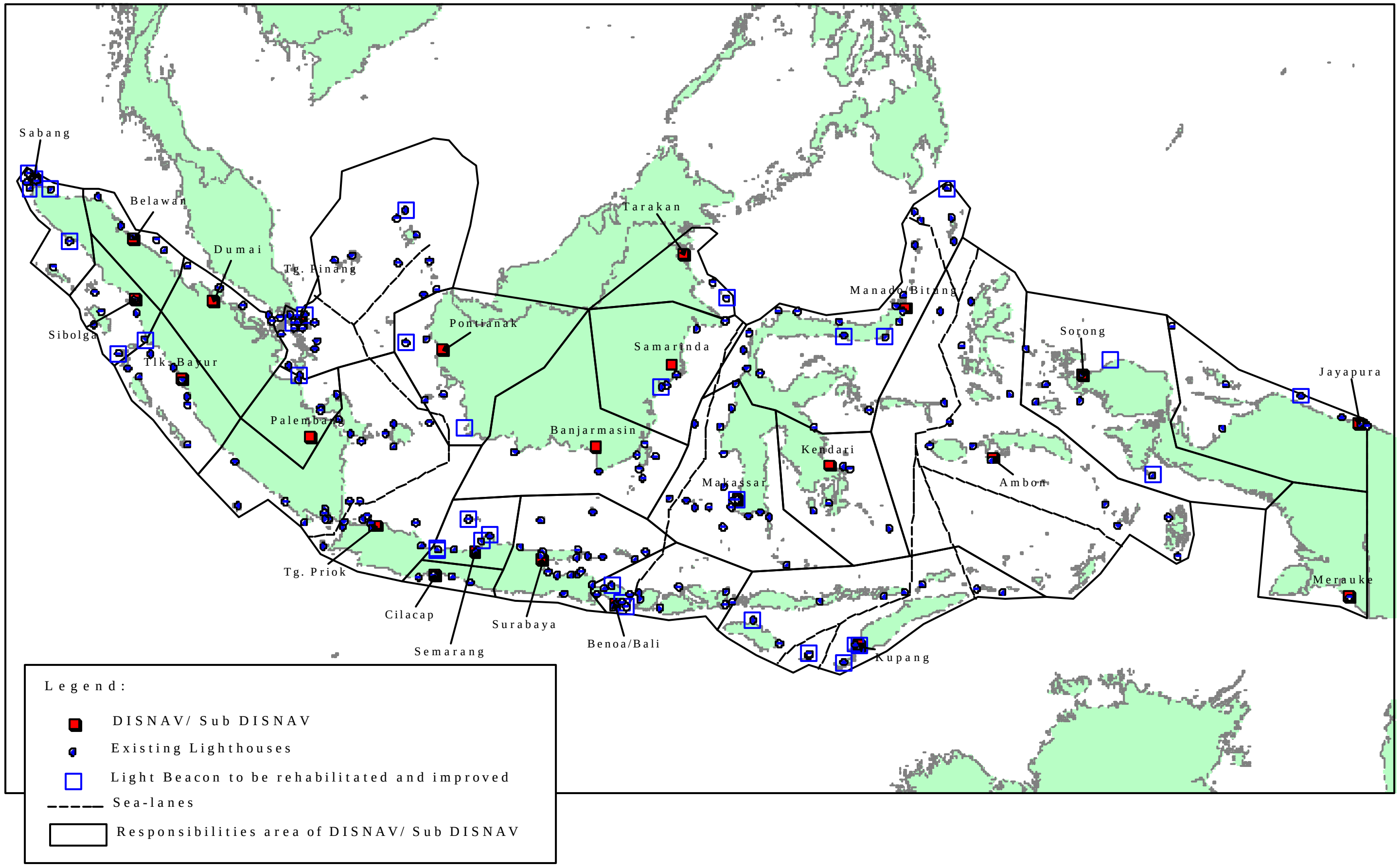


Figure 2.1.2. Location Map of Rehabilitation and Improvement of Light Beacons in Short Term Plan

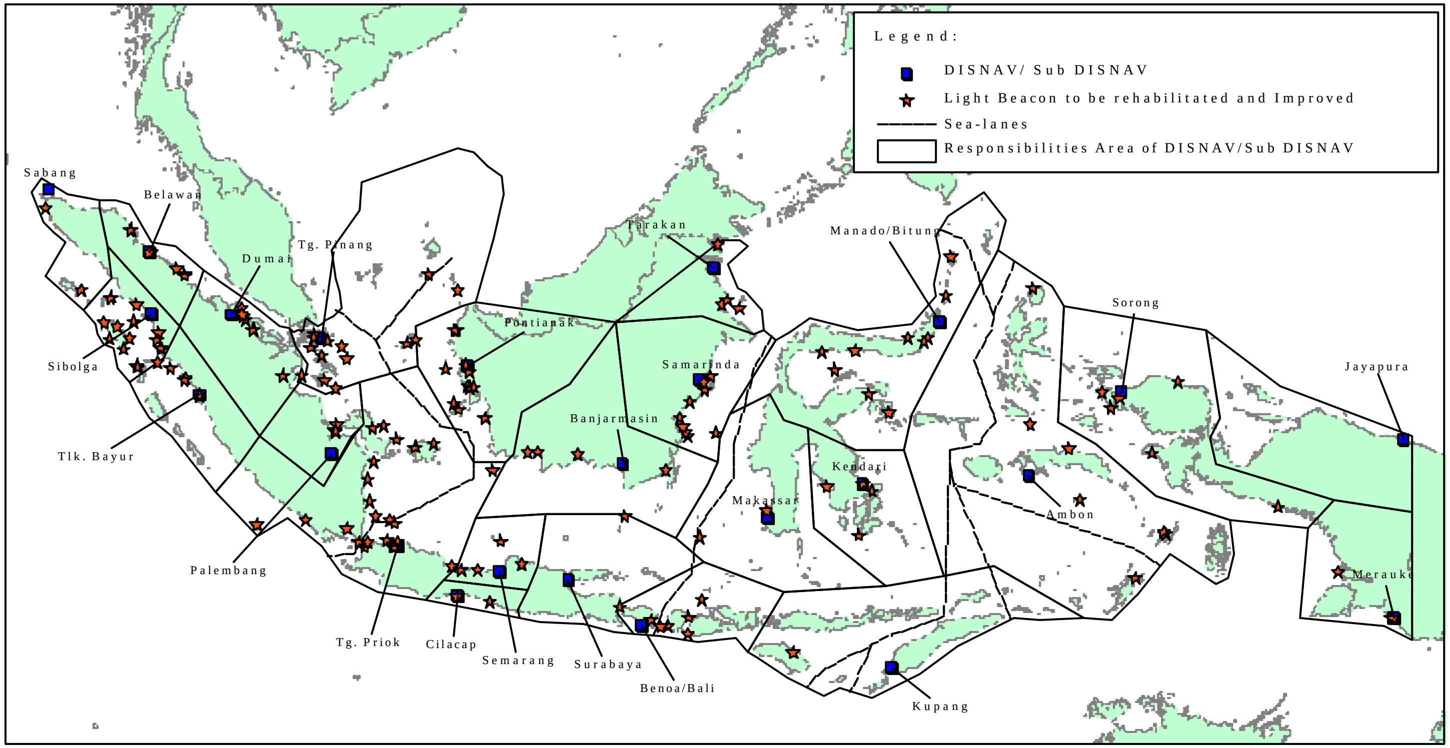
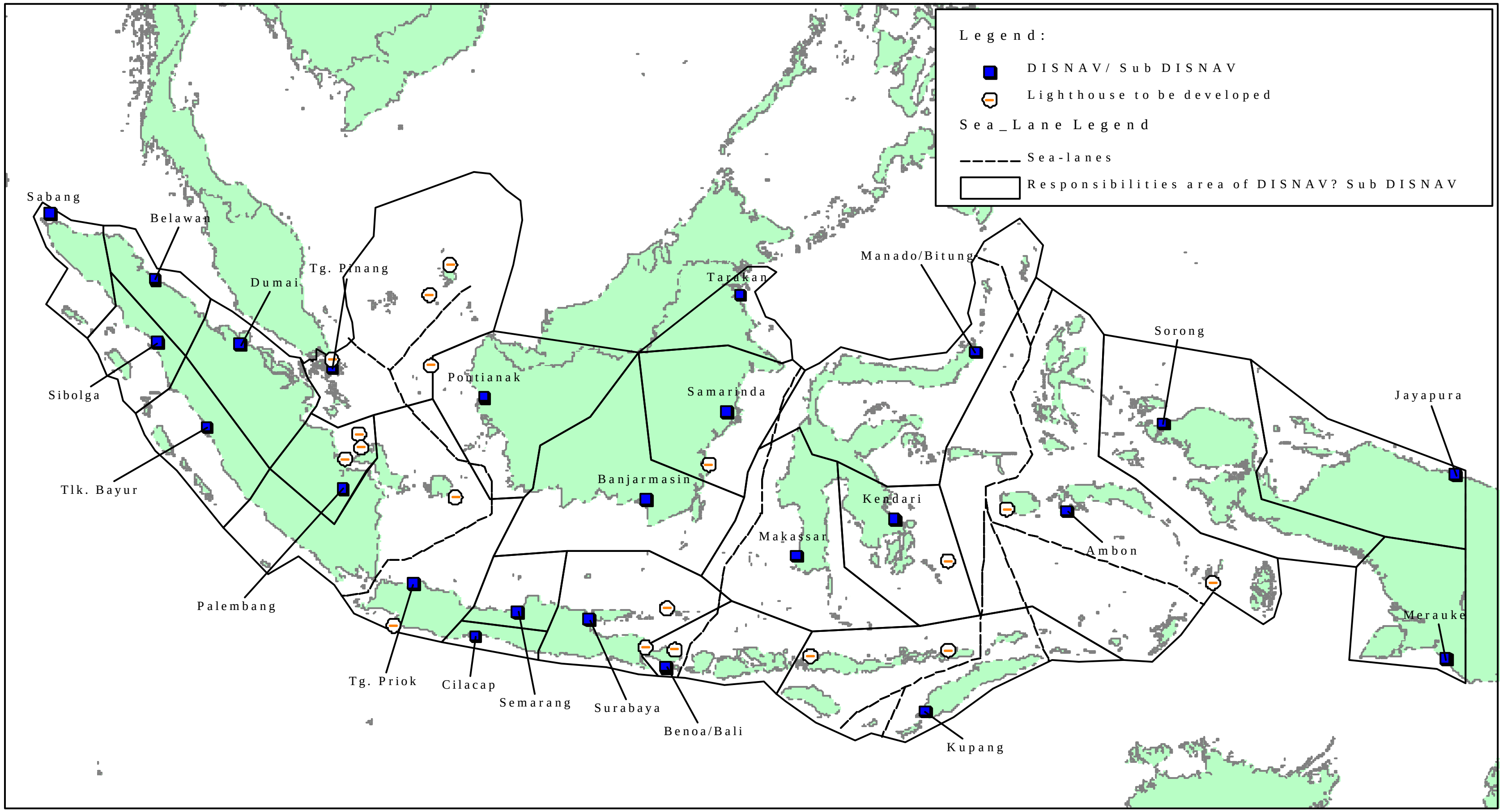
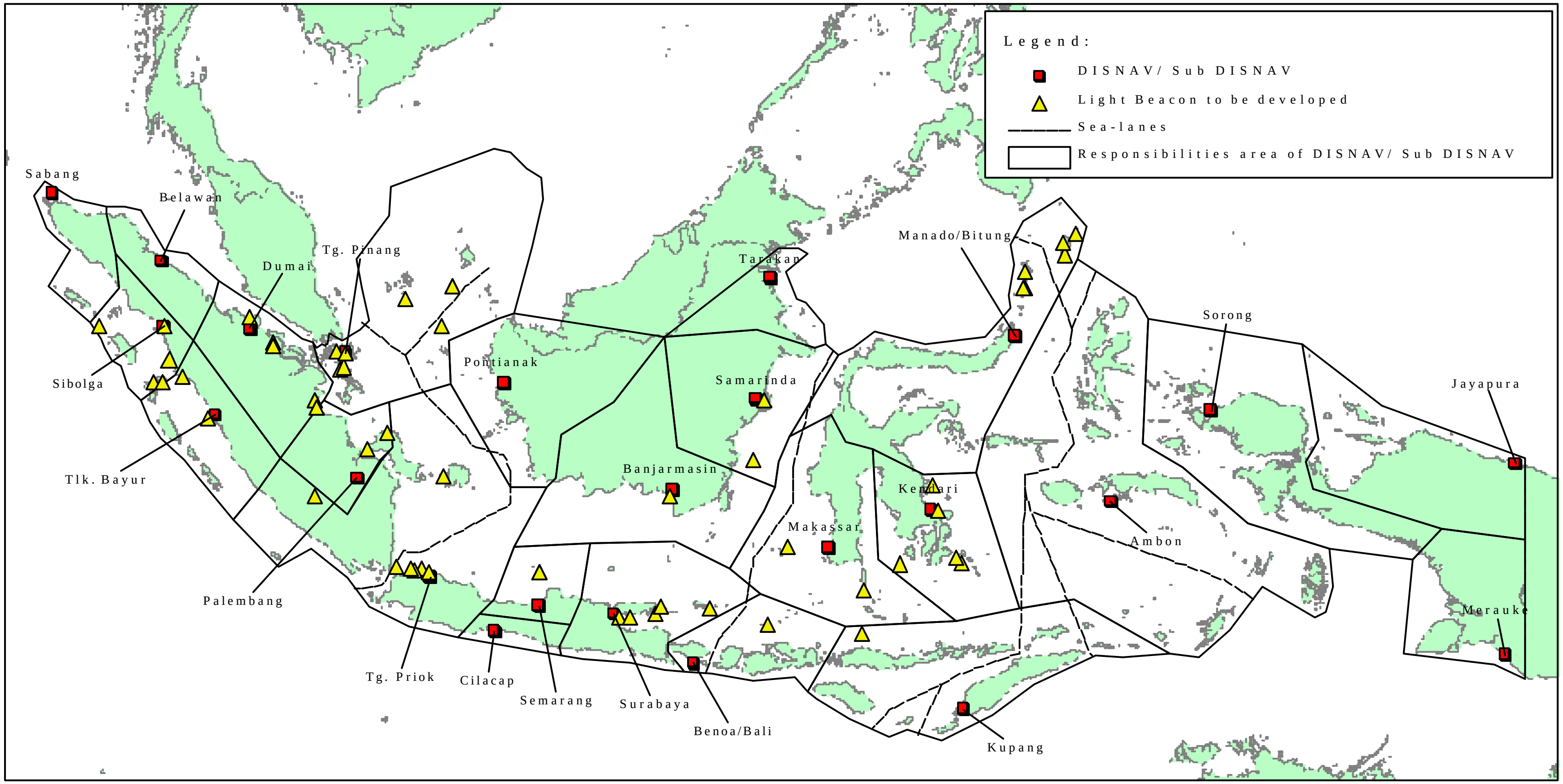


Figure 2.1.3. Location Map of Development of Lighthouses in Short Term Plan



Figurer. 2.1.4. Location Map of Development of Light Beacons in Short Term Plan



2.2. DGPS

2.2.1. 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 passage of foreign ships on international voyage must be considered as policy of GOI.

As the **first stage of selection**, the locations of proposed DGPS stations were selected from fifteen (15) locations specified in the Master Plan.

The locations of proposed DGPS stations that cover the sea lanes are eight (8) locations as shown in **Table 2.2.1**.

Table 2.2.1. Locations of Proposed DGPS Station around Sea lanes

NO	NAME	CLASS	LATITUDE	LONGUITUDE	No. of Sea-lane
6	Jakarta	I	06-07-28S	106-51-16E	1
9	Benoa	III	08-77-70S	115-12-32E	2
10	Kupang	II	10-12-49S	123-37-05E	3
11	Pontianak	III	00-01-26S	109-19-06E	1
13	Balikpapan	II	01-16-02S	116-49-37E	2
15	Makassar	I	05-06-34S	119-26-22E	2
18	Bitung	I	01-27-03N	125-11-03E	3
19	Ambon	I	03-41-57S	128-10-40E	3

As the **second stage of selection**, the locations of the Short Term Plan were further extracted from eight (8) proposed DGPS stations that cover the seawaters of three (3) sea lanes.

The selection of locations for the Short Term Plan must be considered the following Point:

① Priority of sea lane specified by GOI

② Priority of sea lane based on traffic density and needs

a. Priority specified by GOI

The priority specified by GOI is as follows:

Priority 1	Sea Lane Ⅰ
Priority 2	Sea Lane Ⅱ
Priority 3	Sea Lane Ⅲ

b. Priority of sea lane based on traffic density and needs

Based on the result of density survey and survey of GPS needs including DGPS described in **Volume 1, Chapter 2 and Chapter 6** respectively, the priority of sea lane based on the traffic density and needs is judged as follows:

- As a result of the traffic density survey by the JICA Study Team, the density of ships per day on the Sea Lane Ⅰ, Ⅱ and Ⅲ becomes low from Sea Lane Ⅰ to Ⅲ in order.
- As a result of the survey of GPS needs including DGPS, same result was obtained from respondents of questionnaires.

That is;

Priority 1	Sea Lane Ⅰ
Priority 2	Sea Lane Ⅱ
Priority 3	Sea Lane Ⅲ

③ Other necessary consideration

There are Jawa Sea between the Sea Lane Ⅰ and Sea Lane Ⅱ.

Jawa Sea has the waters where there are many traffic routes and tankers, passenger ships, container ships and so forth that are crossing from north to south and east to west, vice versa.

Jawa Sea is a important waters to connect major islands each other such as Jawa, Kalimantan, Sulawesi and Sumatera.

Therefore, the locations of proposed DGPS stations for the Short Term Plan were furthermore extracted from eight (8) proposed DGPS stations that cover three (3) sea lanes.

The locations that cover sea lanes of priority 1 and priority 2 are shown in **Table 2.2.2.**

Table 2.2.2. Locations of Priority 1 and Priority 2

NO	NAME	CLASS	LATITUDE	LONGUITUDE	No. of Sea-lane
6	Jakarta	I	06-07-28S	106-51-16E	1
9	Benoa	III	08-77-70S	115-12-32E	2
11	Pontianak	III	00-01-26S	109-19-06E	1
13	Balikpapan	II	01-16-02S	116-49-37E	2
15	Makassar	I	05-06-34S	119-26-22E	2

On the other hand, the priority of each location specified in the Master Plan based on the evaluation of waters covered by the proposed DGPS stations is shown in **Table 2.2.3.**

Table 2.2.3. Priority of each Location in the Master Plan

NO	NAME	CLASS	LATITUDE	LONGUITUDE	Priority
6	Jakarta	I	06-07-28S	106-51-16E	1
9	Benoa	III	08-77-70S	115-12-32E	4
11	Pontianak	III	00-01-26S	109-19-06E	7
13	Balikpapan	II	01-16-02S	116-49-37E	6
15	Makassar	I	05-06-34S	119-26-22E	2

As the **final stage of selection**, the locations of proposed DGPS stations for the Short Term Plan, the following criteria must be considered:

- Importance of the waters such as narrow entrance having many national ships crossing strategic sea lane
- Priority given to the proposed DGPS stations as a result of evaluation in the Master Plan

The narrow entrances having many national ships crossing strategic sea lane are Sunda Strait and Lombok Strait. The locations of proposed DGPS stations that cover such narrow entrance are No. 6 Jakarta and No. 9 Benoa.

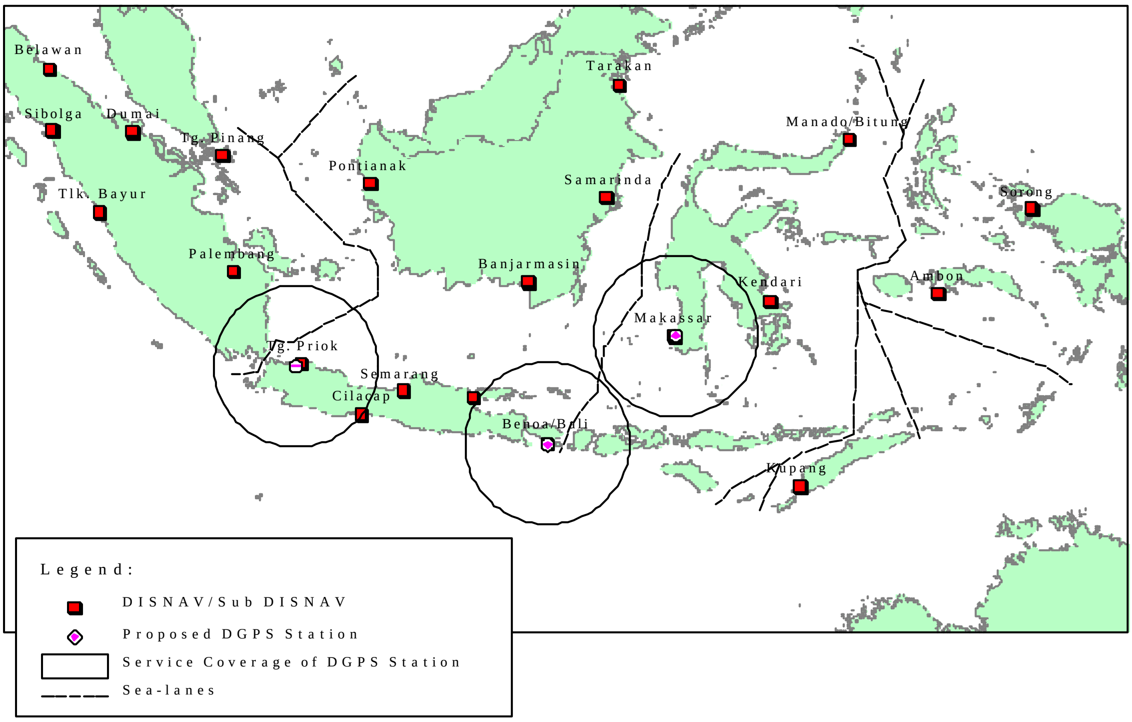
The proposed No.15 Makassar DGPS station is located at a important position as a junction port between Eastern Indonesia and Western Indonesia. Its priority specified in the Master Plan is priority 2.

Three (3) locations of proposed DGPS stations are finally selected for the Short Term Plan as shown in **Table 2.2.4.**

Table 2.2.4. 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 2.2.1 Service Coverage of Proposed DGPS Stations in Short Term Plan



The three (3) DGPS stations proposed in the Short Term Plan mainly cover the following waters:

① Jakarta DGPS Station

- Sunda Strait,
- About 290 nautical miles from the end of south entrance of Sea Lane Ⅰ
- Pulau-Pulau Seribu

② Benoa DGPS Station

- Lombok Strait
- South entrance of Sea Lane Ⅱ
- About 160 nautical miles from the end of south entrance of Sea Lane Ⅱ
- Pulau-Pulau Kagean

③ Makassar DGPS Station

- Three (3) approach channels to Makassar Port
- About 240 nautical miles of the middle of Sea Lane Ⅱ
- Pulau-Pulau Sangkarang and Pulau-Pulau Kalkalkuang

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.

2.2.2. Implementation Schedule of DGPS Stations for Short Term Plan

Implementation schedule of Short Term Plan for DGPS Stations is shown in **Table 2.2.5.**

Table 2.2.5. DGPS Implementation Schedule

Site No.	Site Name	Year									
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2015
06	Jakakarta						▬	▬	▬		
09	Benoa						▬	▬	▬		
15	Makassar						▬	▬	▬		

2.2.3. Cost Estimate for Short Term Plan

The estimated project cost for the Short Term Plan is shown in **Table 2.2.6.**

Table 2.2.6. Project Cost for Short Term Plan

Unit: Thousand US$

Description / Phase	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

2.3. Supporting Facilities for Aids to Navigation

The short-term plans of the supporting facilities for visual aids to navigation service up to the year of 2007 are made under the consideration of improvement and development plan of visual aids to navigation.

For the selection of the development and improvement, the followings are considered:

- Services loads for the aids to navigation services
- Increasing of number of the aids to navigation
- Conditions of mission given to the vessel
- Age, Technical condition and scrap plan of vessel
- Space and storage the buoy body and mooring equipment
- Degrading ratio of the workshop equipment
- Development of Eastern Indonesia

2.3.1 Vessels for Aids to Navigation Services

At present, age of vessels for aids to navigation service are as shown in **Table 2.3.1.**

Table 2.3.1. Age of Vessels for Aids to Navigation Services

Vessels Age	At Present
0-15 Years	15
16-25 Years	7
26-35 Years	25
36-40 Years	8
More than 40 Years	20
Total	75

As mentioned in **Section 1.3.** of **Part 1-Chapter 1**, when DISNAVs or Sub DISNAVs intend to send vessels to visit the site according to the indicated new intervals of visit for maintenance, some of DISNAVs will realize the shortage of vessels. Therefore, rehabilitation of overage vessels to prolong the life and reassignment of vessels will be needed.

Vessels need to be rehabilitated up to year of 2015 are six (6) Buoy Tenders, nineteen (19) Aids Tenders, seven (7) Inspection Boats and one (1) Survey Vessel, these are thirty-three (33) in total. It is considered that some DISNAVs still feel the shortage of vessels. In such a case, other type of vessels will be able to cover the shortage of vessels.

Anyway, by the scrapping of overage vessels and increase of aids to navigation facilities, it is estimated that the shortage of vessels up to the year of 2015 will be reached to nineteen (19). They are three (3) Buoy Tenders, six (6) Aids Tenders and ten (10) Inspection Boats, and they must be built within this period. The implementation schedule for vessels is shown in **Table 2.3.2**.

DISNAV Ambon has a vast responsibility area for operation and maintenance of aids to navigation. So, one (1) multipurpose vessel that is buoy tender, is required in order to maintain and operate efficiently.

Table 2.3.2. 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	

Estimated project cost for vessels to be rehabilitated and developed in the Short Term Plan is shown in **Table 2.3.3**.

Table 2.3.3. 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

2.3.2. Buoy Base and Workshop

The buoy base and workshop The standard area plan for the workshop and buoy base up to the year of 2020 is shown in **Table 2.3.4**. in accordance with the management load of aids to navigation service at the target year of 2020.

Table 2.3.4. Standards for Facilities of Workshops and Buoy Bases

No.	Name of Facility	DISNAV I Class I	DISNAV II / Sub DISNAV Class II
1	Buoy Base	3000 ㎡	1000 ㎡
2	Open storage	200 ㎡	100 ㎡
3	Workshop *	1000 ㎡	600 ㎡
4	Storage	1000 ㎡	500 ㎡
6	Jetty	80m	60m

Note: * outline of workshop equipment is shown in Master Plan **Table 1.3.15**.

The following locations are selected for the improvement and development project in the Short Term Plan from the Master Plan:

(1) Buoy base

1)Buoy bases to be improved

1)-1 Buoy bases

① DISNAV Tg. Priok (Class I)	(Rising ground level(GL))
② Sub DISNAV Cilacap (Class II)	(Enlargement)
③ DISNAV Samarinda (Class I)	(Enlargement)
④ DISNAV Sorong (Class I)	(Enlargement)

1)-2 Open storage

① DISNAV Tg. Priok (Class I)	(Enlargement and rising GL)
② DISNAV Sorong (Class I)	(Enlargement)

2)Buoy bases to be developed

2)-1 Buoy base

① DISNAV Tg. Pinang	(Class I)
② DISNAV Semarang	(Class II)
③ DISNAV Benoa	(Class II)
④ Sub DISNAV Pontianak	(Class II)
⑤ DISNAV Ambon	(Class I)
⑥ DISNAV Jayapura	(Class II)

2)-2 Open storage

① DISNAV Belawan	(Class II)
② DISNAV Tg. Pinang	(Class I)
③ DISNAV Tlk. Bayur	(Class II)
④ DISNAV Palembang	(Class II)
⑤ DISNAV Semarang	(Class II)
⑥ DISNAV Benoa	(Class II)
⑦ Sub DISNAV Kendari	(Class II)
⑧ DISNAV Makassar	(Class I)
⑨ DISNAV Kupang	(Class II)
⑩ DISNAV Jayapura	(Class II)

(2) Workshop, and its storage

1)Workshop

① DISNAV Dumai	(Class I)
② DISNAV Palembang	(Class II)
③ DISNAV Surabaya	(Class I)
④ DISNAV Samarinda	(Class I)
⑤ DISNAV Jayapura	(Class II)
⑥ Sub DISNAV Merauke	(Class II)
⑦ BTKP	(BTKP)

Standard of workshop equipment for each DISNAV/Sub DISNAV is shown in **Table 1.3.15** of **Chapter 1.3, Volume I.**

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

1) Jetty to be developed

① DISNAV Banjarmasin (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.

Implementation schedule for the project of improvement and development of buoy base and workshop in the Short Term Plan is shown in **Table 2.3.5.**

Table 2.3.5. 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						

Estimated cost for the improvement and development of buoy base and workshop is shown in **Table 2.3.6.**

Table 2.3.6. 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

2.4. VTS System

2.4.1. General

Seventeen (17) sites are specified as project sites for Master Plan in Chapter 1.4 . List of project sites for Mater Plan is shown as **Table 2.4.1. (1).**

Table 2.4.1. (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 formulate VTS System for Short Term Plan, we must select project site and decide Main/Sub Center to control the selected project sites. To select project site, the following items must be considered deeply:

- Importance of sea area such as entry/exit area of sea lane having many national ships crossing strategic sea lane,
- Steadiness to formulate VTS System and expansibility in future for the time being,
- Usefulness for safety navigation, surveillance of sea lane and especially usefulness as training center for operators of VTS,
- Position of GOI that designated three (3) sea lanes in archipelagic waters for passage of foreign vessels on international voyage.

2.4.2. Selection of Project Sites

(1) Evaluation of site status for project sites of remote station.

The project site for Short Term Plan is chosen from fourteen- (14) project sites specified as Master Plan. All project sites of Master Plan are evaluated upon some aspects specified as follows:

- Aspect of strategy,
- Aspect of navigational hazard,
- Aspect of environmental situation,
- Aspect of traffic density and patters,
- Aspect of relation with existing VTS,
- Aspect of volume of passenger,
- Aspect of priority specified by GOI.

Evaluation criteria are provided to evaluate status of project sites and shown as **Table 2.4.2. (1).**

Table 2.4.2. (1) Evaluation Criteria for Project Site (1)

No.	Item	Evaluation point				
		5	4	3	2	1
1.	Aspect of strategic	Entrance of sea lane		Others		
2	Aspect of navigational hazard	Dangerous sea area for navigation		There is hazard along sea lane		No hazard for navigation
3	Aspect of environmental situation	There is sea area to be protected or cause of contamination such as chemical plant, Oil terminal and others.		There is sea area to be protected from contamination.		
4	Aspect of traffic density and patters	Sea area where sea lane is crossed with ferry route and density of traffic is high	Sea area where is crossed by ferry route.	There is sea area where vessels are navigating.		There is sea area where few vessel is navigating.
5	Aspect of relation with existing VTS	Sea area where is covered by existing VTMS.		Sea area where is not covered by existing VTMS.		
6	Aspect of volume of passenger	Sea area where a lot of passenger is passing.	Sea area where many passenger is passing.	Sea area where passenger is passing.		Sea area where few passenger is passing.
7	Aspect of priority specified by GOI	Sea Lane I	Sea Lane II	Sea Lane III		

Fourteen (14) project sites are evaluated based on evaluation criteria shown as **Table 2.4.2. (1)** and evaluation result is shown in **Table 1.4.2. (2)** .

Table 2.4.2. (2) Evaluation Sheet for Each Project Site

Site ID	Name of Project site	Targeted seawater area	Name of related sea-lane	Nos. of radar	Nos. of AIS	Evaluation items							Total points	Level of Priority
						Aspect of Strategic	Aspect of Navigational Hazard	Aspect of Environmental situation	Aspect of Traffic density and patters	Aspect of relation with Existing VTS	Aspect of volume of passenger	Aspect of priority specified by GOI		
11	Tanjung Lesung	Sunda Strait Area	I		1	5	1	4	5	5	1	5	26	**3**
12	Merak	Sunda Strait Area	I	1	1	3	3	5	5	5	5	5	31	**1**
13	Sarutu Island	Kalimata Strait Area	I		1	3	3	3	4	5	1	5	24	**5**
14	Natuna Island	Natuna Area	I		1	5	3	3	3	5	1	5	25	**4**
21	Tanglad	Lombok Strait Area	II	1	1	5	1	5	4	5	3	4	27	**2**
22	Kalukalukuang Island	South Makassar Area	II		1	3	3	3	3	5	1	4	22	6
23	Buttu Tuopoang	Central Makassar Area	II		1	3	1	3	3	5	1	4	20	8
24	Buttu Salome	North Makassar Area	II		1	5	1	3	3	5	1	4	22	6
31	Alor Island	Ombai Strait	III		1	5	1	3	3	5	1	3	21	7
32	Pulau Reong	Romang Strait Area	III		1	3	1	3	1	5	1	3	17	10
33	Molu Island	Banda Sea Area	III		1	5	1	3	1	5	1	3	19	9
34	Sulabes Island	Banda sea Area	III		1	3	1	3	3	5	1	3	19	9
35	Maju Island	Moluca Sea Area	III		1	3	1	3	3	5	1	3	19	9
36	Maru Island	Pulau Maru Sea Area	III		1	5	1	3	1	5	1	3	19	9

(2) Project sites of remote station for Short Term Plan

Point is given to each project site in **Table 2.4.2. (2).** The priority of each project site is derived from evaluation result. The five (5) project sites having high priority are listed in **Table 2.4.2. (3).**

Table 2.4.2. (3) Result of Evaluation (1)

Level of Priority	Name of 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

Comment for each project site is given as follows:

① Merak specified as priority No.1 is along Sunda Strait that is one of the most important sea areas for Indonesia. This project site is also useful to monitor vessels that will navigate into Sea Lane Ⅰ.

② Tanglad specified as priority No.2 is along Lombok Strait that is one of most important sea areas for Indonesia. This project site is also useful to monitor vessels that will navigate into Sea Lane Ⅱ.

③ Tanjung Lesung specified as priority No.3 is located at southwest of Jawa Island. This project site is a good position to monitor vessels coming from Indian Ocean. It has more difficulty to formulate system because this project site is isolated area and not easy to access.

④ Natuna Island specified as priority No.4 is located at South China Sea. It is the entrance for Sea Lane Ⅰ.

⑤ Sarutu Island specified as priority No. 5 is located at Kalimata Strait where width of sea lane is narrow.

To decide project site finally, the marine casualty and accessibility to project site is deeply considered. Marine casualties related Sunda and Lombok Strait is shown as **Table 2.4.2.(4).**

Table 2.4.2. (4) Marine C asualty related Sunda and Lombok Strait (1993～2000)

Name of strait	Kind of casualty	Frequency	Victim
Sunda	Collision	2	3 persons
	Aground	3	None
	Sunken	2	None
Lombok	Sunken	2	14 person died

Source: Statistic report of marine casualty by DGSC.

Evaluation criteria (2) is provided to evaluate five (5) project sites having high priority and shown as **Table 2.4.2. (5).**

Table 2.4.2. (5) Evaluation Criteria (2)

No.	Items	Point				
		5	4	3	2	1
1.	Probability of Marine casualty.	High	Usual	Few		
2.	Availability to project site.	Easier	Easy	Usual	Difficult	

The foresaid five (5) project sites are evaluated by evaluation criteria (2). Evaluation result is shown as **Table 2.4.2. (6).**

Table 2.4.2. (6) Result of Evaluation (2)

Site ID	Name of Project site	Level of Priority for pre-evaluation	Point			
			Probability of Marine casualty	Accessibility to Site	Total points	Level of Priority for Short Term
11	Tanjung Lesung	3	3	3	6	3
12	**Merak**	**1**	**5**	**5**	**10**	**1**
13	Sarutu Island	5	3	2	5	4
14	Natuna Island	4	3	2	5	4
21	**Tanglad**	**2**	**4**	**4**	**8**	**2**

Result of evaluation (2) and comment for each project site are studied and project sites for Short Term Plans are finally decided and project sites are shown in **Table 2.4.2. (7).**

Table 2.4.2. (7) Project Sites for Short Term Plan

No.	Name of Project site for remote station	Targeted sea area
1.	Merak	Sunda Strait sea area
2.	Tanglad	Lombok Strait sea area

(3) Project site of Main/Sub Center for Short Term.Plan

Project sites of remote stations are selected in previous clause. Now we must select project site of Main/Sub Center from project sites that are listed in **Table 2.4.2. (7).** Project sites of remote stations for Merak and Tanglad are located at Sunda and Lombok Strait respectively. Therefore we must provide Sub Center at Sunda and Lombok Strait area. Relation of remote station and Sub Center is listed in **Table 2.4.2. (8)**.

Table 2.4.2. (8) Relation of Remote Station and Sub Center

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)

Formulation of Main Center is not described because Main Center will be formulated in Phase –2.

2.4.3. Project Cost for Short Term Plan.

Project cost is estimated as follows:

Table 2.4.3. (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

2.5. GMDSS Expansion and Improvement

2.5.1. General

GMDSS was put into service in February 1992 and fully implemented in February 1999 in accordance with the regulations of SOLAS Convention.

As for GMDSS shore-based facilities in Indonesia, so far DGSC has installed MF DSC for Sea Area A2 and VHF DSC for Sea Area A1 at each 30 coast station, 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.

Therefore, the following GMDSS expansion and improvement should be implemented as an urgent project, and the station list for GMDSS should be notified to International Maritime Organization (IMO) after their completion.

2.5.2. 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	(Palembang)
2nd class ;	3 stations	(Sabang, Teluk Bayur and Banjarmasin)
3rd class ;	2 stations	(Samarinda and Bau-bau)
4th class ;	13 stations	(Tapaktuan, Natuna, Pangkal Balam, Bengkulu, Bima, Ende, Ketapang, Sampit, Poso, Toli-toli, Tual, Saumlaki and Agats)

The expanded coverage for Sea Area A2 by Urgent Project is shown in **Figure 1.5.4.**

(2) Sea Area A1 by VHF DSC

The following existing stations should be installed with VHF DSC to cover waters around main ports, and important navigation waters:

1st class ;	1 station	(Palembang)
2nd class ;	3 stations	(Sabang, Teluk Bayur and Banjarmasin)
3rd class ;	5 stations	(Tg. Uban, Jambi, Cirebon, Samarinda and Bau-bau)
4th class ;	24 stations	(Tapakutuan, Lhokseumawe, Kuala Tanjung, Kuala Enok, Natuna, Pangkal Balam, Muntok, Bengkulu, Cigadang, Klianget, Meneng. Bima,

Ende, Maumere, Ketapang, Sampit, Kumai, Batulicin, Pare-pare, Poso, Toli-toli, Tual, Saumlaki and Agats)

The expanded coverage for Sea Area A1 by Urgent Project is shown in **Figure 1.5.6.**

2.5.3. Introduction of National NAVTEX

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 “IMORTANT” categories. However, message can be received by receivers of International NAVTEX without any modification, as the Indonesian alphabet is the same as that of English.

The present International NAVTEX stations (Jakarta, Makassar, Ambon and Jayapura) are to be used for this purpose. The coverage areas of National NAVTEX using 518 kHz is shown in **Figure 1.5.3.**

All above items are summarized in **Table 1.5.3.**

2.5.4.Cost Estimate

The cost for GMDSS expansion in Urgent Project is estimated in **Table 2.5.1.**

Table 2.5.1 .Cost for GMDSS Expansion in Urgent Project

Unit: Thousand US$

A2, A1 Expansion	National NAVTEX	Total
22,014	(not required)	22,014

2.6. Indonesia Ship Reporting System

2.6.1. 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.

At the 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 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.

2.6.2. Concept of Indonesia Ship Reporting System

Proposed framework of Indonesia Ship Reporting System is as follows:

(1) System's name

Indonesia Ship Reporting System is tentatively called INDOSREP.

(2) Area to be covered

Search and Rescue Region (SRR) will be suggested as a reporting area in accordance with SAR Convention. Indonesian SRR is shown in **Figure 1.6.5.**

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)	for departure
② Position report (PR)	with necessary interval
③ Deviation report (DR)	as needed

④ Final report (FR) on arrival at destination

Special Reports;

① Dangerous goods report (DG) when an incident takes place

② Harmful substances report (HS) when an incident takes place

③ Marine pollutants report (MP) in the case of loss or likely loss overboard of harmful substances

(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

2.6.3. System Composition

System configuration of INDOSREP is shown in **Figure 1.6.6.**

(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 or 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 through 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 at Jakarta, Tg. Priok. 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 reports transmission at the 1st stage is as follows:

Center	~	Sub-Centers	:	Internet / Existing HF
Sub-Centers	~	3rd class stations	:	Existing HF

The project sites are shown in **Figure 2.6.1.** and **Table 1.6.2.**

2.6.4. Cost Estimate

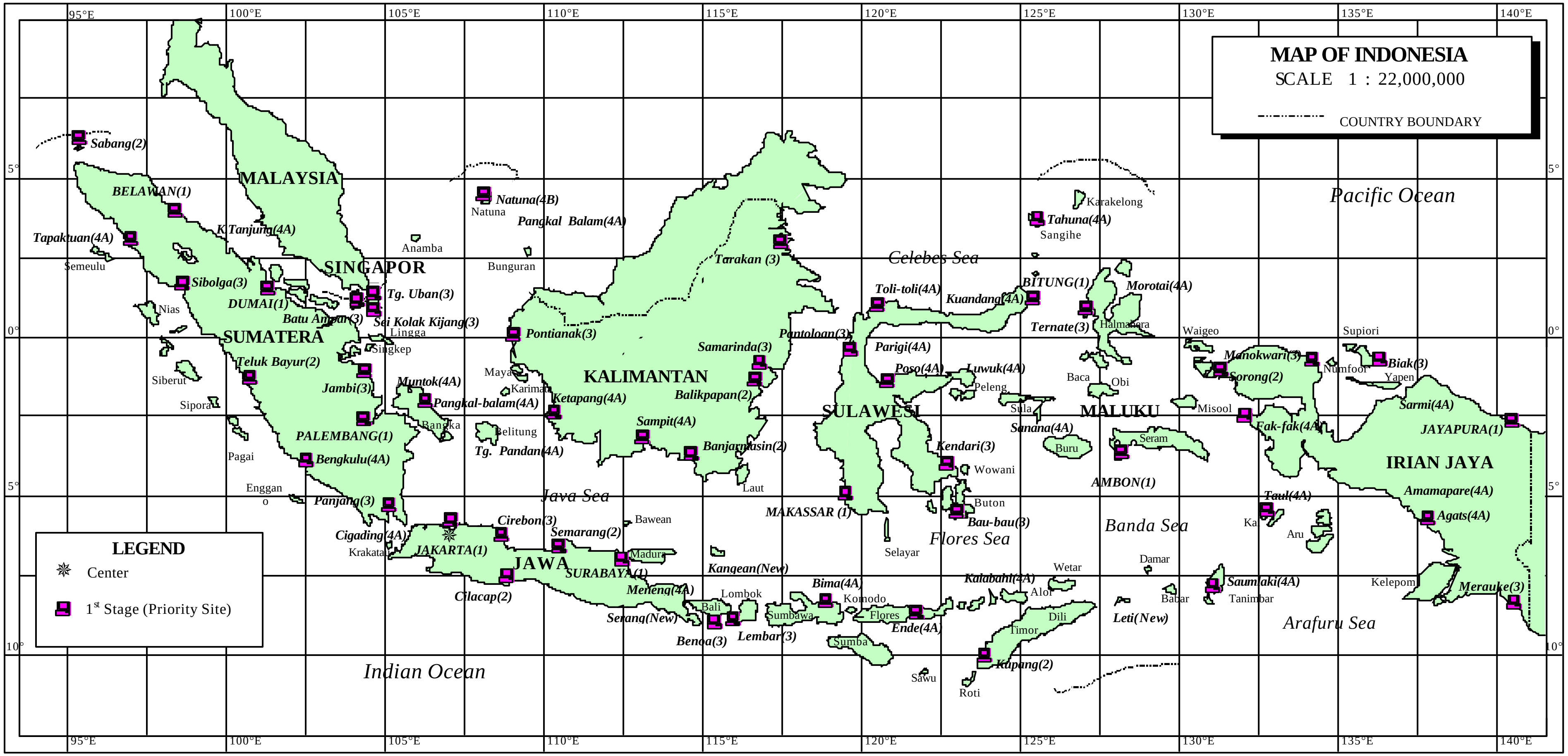
Estimated cost for establishment of ship reporting system is shown in **Table 2.6.1.**

Table 2.6.1. Cost for Ship Reporting System

Unit: Thousand US$

Center	Sub-Center (1st and 2nd class)	3rd class	Total
1,779	9,355	314	11,448

Figure 2.6.1. Project Sites of Ship Reporting System



2.7. Replacement and Improvement of Aged Equipment/Facilities

2.7.1. 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.

2.7.2. 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

Although Teluk Bayur (2nd) and Benoa (3rd) stations are located at key spots for maritime safety and has many links with other lower class coast stations, both stations have been operated at a single site where the transmitters and receivers are collocated.

Those stations should be separated into transmitting and receiving sites. In addition, Benoa station should be classified as the 2nd class station.

(2) Improvement of environment for coast stations

In Surabaya (1st) and Makassar (1st) coast stations, noises caused by city activities are very big, and these are unsuitable for the environment of receiving stations. Furthermore, the transmitting and receiving sites of Surabaya and Makassar stations are too limited in space to ensure the antenna system of the 1st class station.

Both for Surabaya and Makasser stations, the transmitting (Tx) station should be moved to new site, and new receiving (Rx) station should occupy the existing Tx station site.

(3) Improvement of VHF coverage

Dumai station (1st) can not communicate with the vessels passing the Strait of Malacca by VHF because of a big Rupat island exists in front of Dumai port.

Samarinda station (3rd) is located about 30 km upriver from the sea and VHF radio wave cannot reach to the coastal line.

These VHF coverages of Dumai and Samarinda coast stations should be expanded.

(4) Improvement of engine-generators

Most engine-generators of the 1st and 2nd class coast stations are old and no spare parts are available at the site or market.

A set of engine-generators with automatic start/stop function should be provided in each of Tx and Rx stations at the 1st and 2nd class stations in substitute for old ones.

(5) Replacement of old antennas

Most antennas of the 1st and 2nd class coast stations are old and should be replaced.

2.7.3. Cost Estimate

The cost for replacement and improvement of aged equipment/facilities are estimated as **US$ 17,787,000.**

2.8. 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 2.8.1.**

The site map of the Master Plans for aids to navigation is shown in **Figure 2.8.1.** and that of telecommunications system is shown in **Figure 2.8.2.**

Table 2.8.1. 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	

Implementation without Cost

Implementation with Cost

Short Term Plans Total Cost (including proposed priority project)	209.717

Figure 2.8.1. Location Map of Aids to Navigation Field on Short Term Plans up to Year 2007

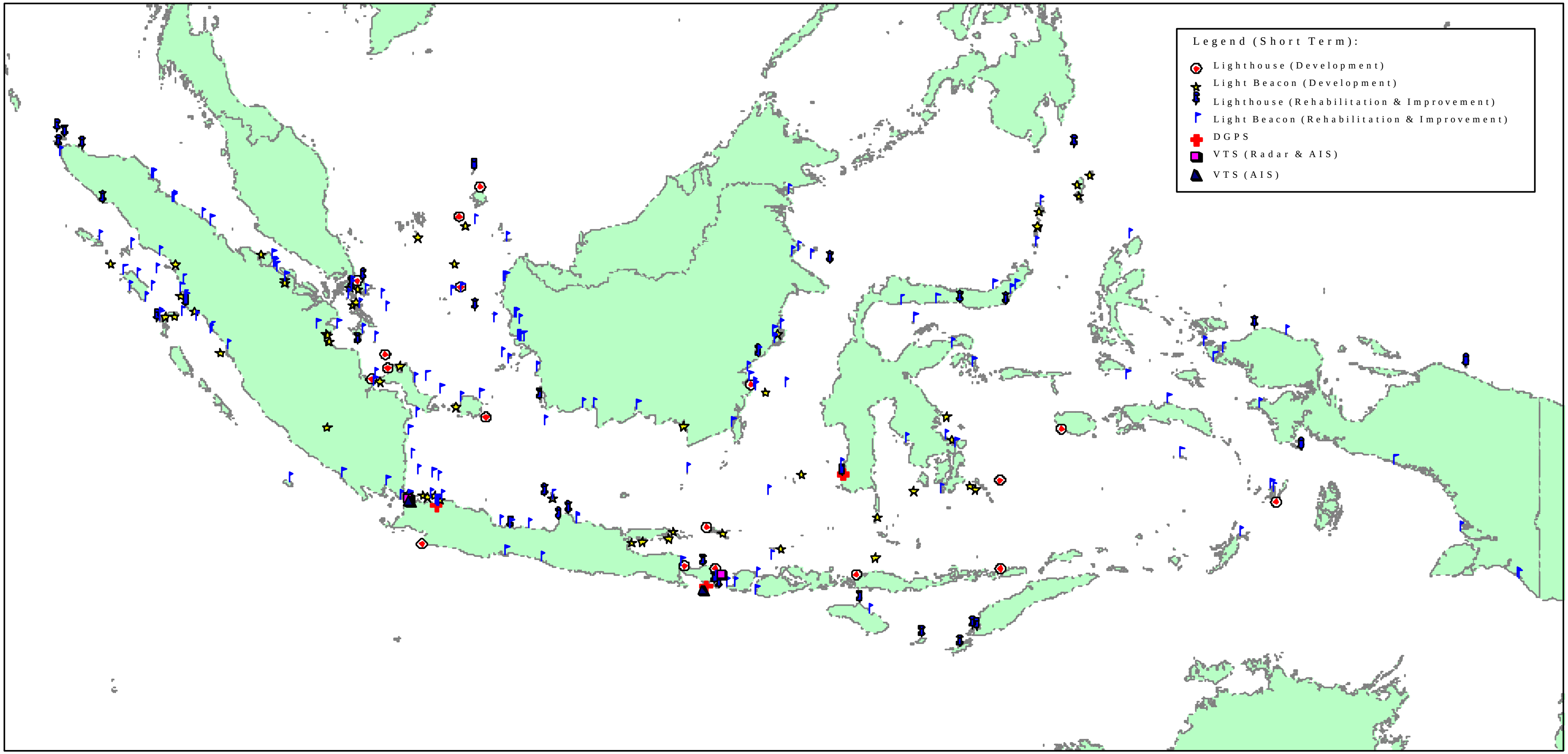
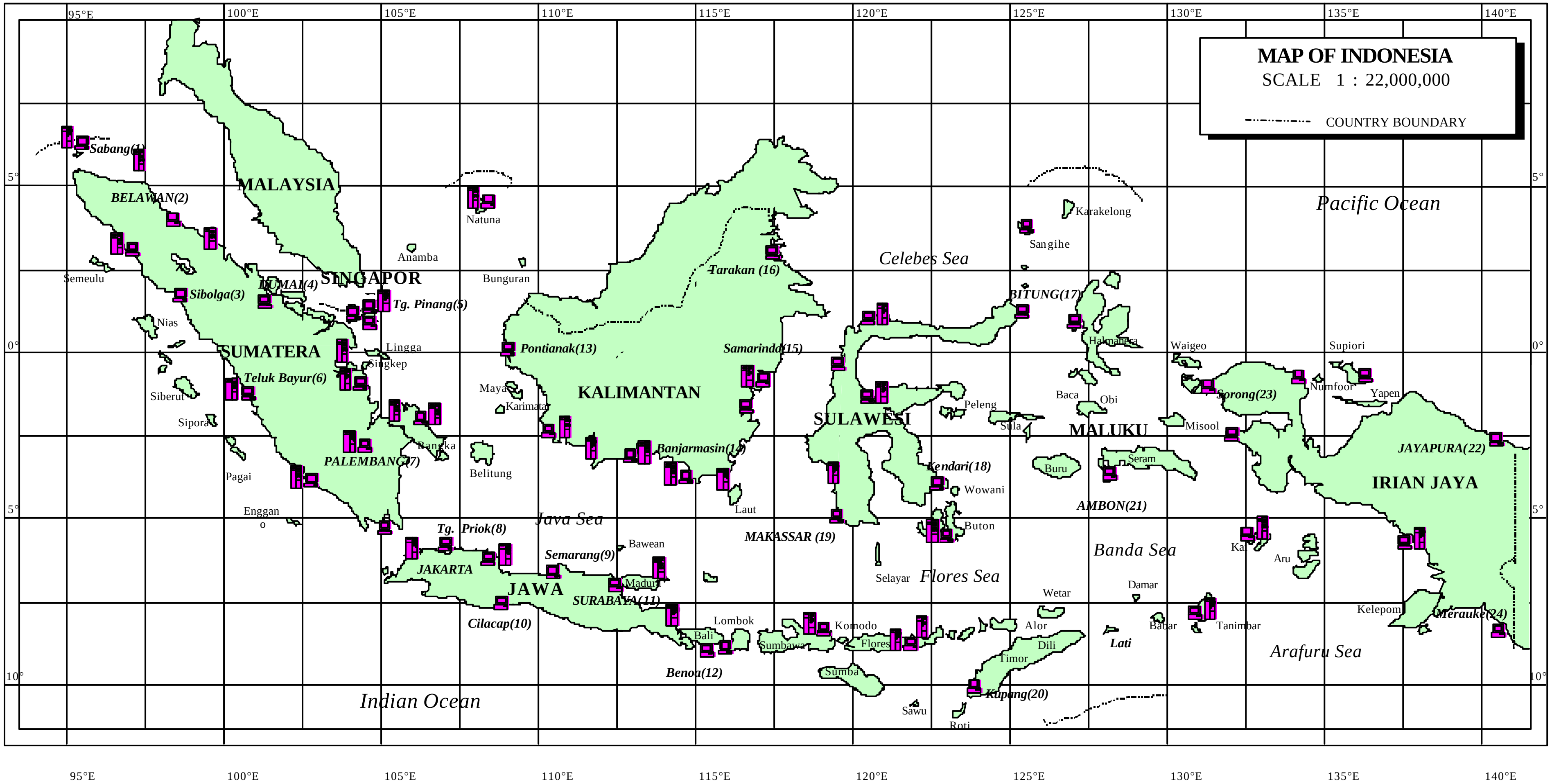


Figure 2.8.2. Location Map of Telecommunication System on Master Plans up to



LEGEND

GMDSS (Short Term Plan)

Ship Reporting System (Short Term Plan)

Name of city/town in map and the number in () shows the location of DISNAV and its number.

CHAPTER 3.

FEASIBILITY STUDY ON PROPOSED PRIORITY PROJECTS

CHPTER 3.
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 5** after evaluation.

3.1. Visual Aids to Navigation Including Supporting Facilities

3.1.1. 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 3.1.1. 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).

Lighthouses and light beacons for rehabilitation and improvement in the Proposed Priority Projects are marked in **Appendix 3.1.1.** and **Appendix 3.1.2 .**respectively as phase 1.

The locations of lighthouses and light beacon for rehabilitation and improvement are shown in **Figure 3.1.1.** and **Figure 3.1.2.**

Light buoy for rehabilitation is same as Short Term Plan, that is all bouys were included in the Proposed Priority Projects, shown in **Appendix 1.1.3.**

(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,.

Criteria of selection for lighthouses and light beacons are the conditions shown in **Table 3.1.2.** and the results of Selection as Short Term Plan are shown in **Appendix 2.1.2.** and **Appendix 2.1.3.** respectively.

Lighthouses to be developed in the Proposed Priority Projects are shown in **Appendix 3.1.3.** And light beacons to be developed in the Proposed Priority Projects are shown in **Appendix 3.1.4.**

The locations of lighthouses and light beacons for development in the Proposed Priority Projects are shown in **Figure 3.1.3.** and **Figure 3.1.4.** respectively.

Light buoys in Proposed Priority Projects are allocated to main ports in SISTRANAS.

Table 3.1.2. Condition of Proposed Priority Project for Lighthouses and Light Beacons

Lighthouse	
	Item of Sea lane is scored 10 points on sea lane no.1 or Item of Dangers and Traffic route, sum of scores is more than 15 points
Light beacon	
	Item of Sea lane is scored more than 2.5 points and Dangers or Marine casualty is scored 10 pointsis or Item of Marine traffic is scored 10 points and Item of Traffic route and Marine casualty, sum of scores is more than 15 points

(3) Implementation schedule

Implementation of Proposed Priority Projects is scheduled as the following **Table 3.1.3.**

Table 3.1.3. Implementation Schedule of Proposed Priority Project of Visual Aids to Navigation

	Type of VATN	Phase	Unit	Master Plan										
				01	02	03	04	05	06	07	08	09	10	11
Rehabili - tation	Light-house	Phase1	21			■	■	■	■	■				
	Light Bacon	Phase1	131			■	■	■	■	■				
	Light Buoy	Phase1	61			■	■	■	■	■				
Develop - ment	Light-house	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 3.1.4.**

There included the cost of rehabilitation for visual aids to navigation.

Table 3.1.4. Total Project Cost for Proposed Priority Project of Visual Aids to Navigation

Unit: Thousand US$

	Priority Project
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

Figure 3.1.1. Location Map of Rehabilitation and Improvement of Lighthouse in Proposed Priority Projects

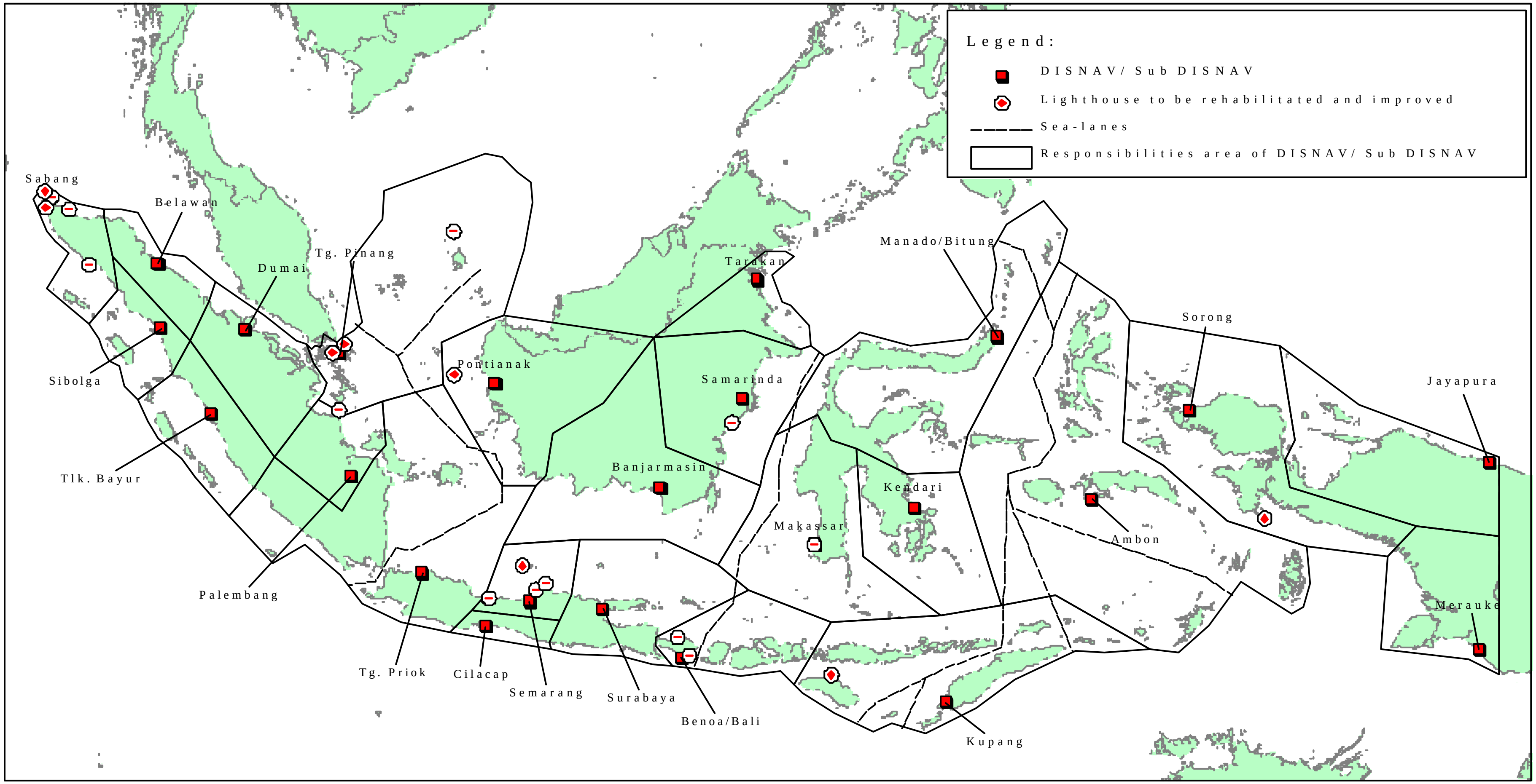


Figure 3.1.2. Location Map of Rehabilitation and Improvement Plan of Light Beacons in Proposed Priority Projects

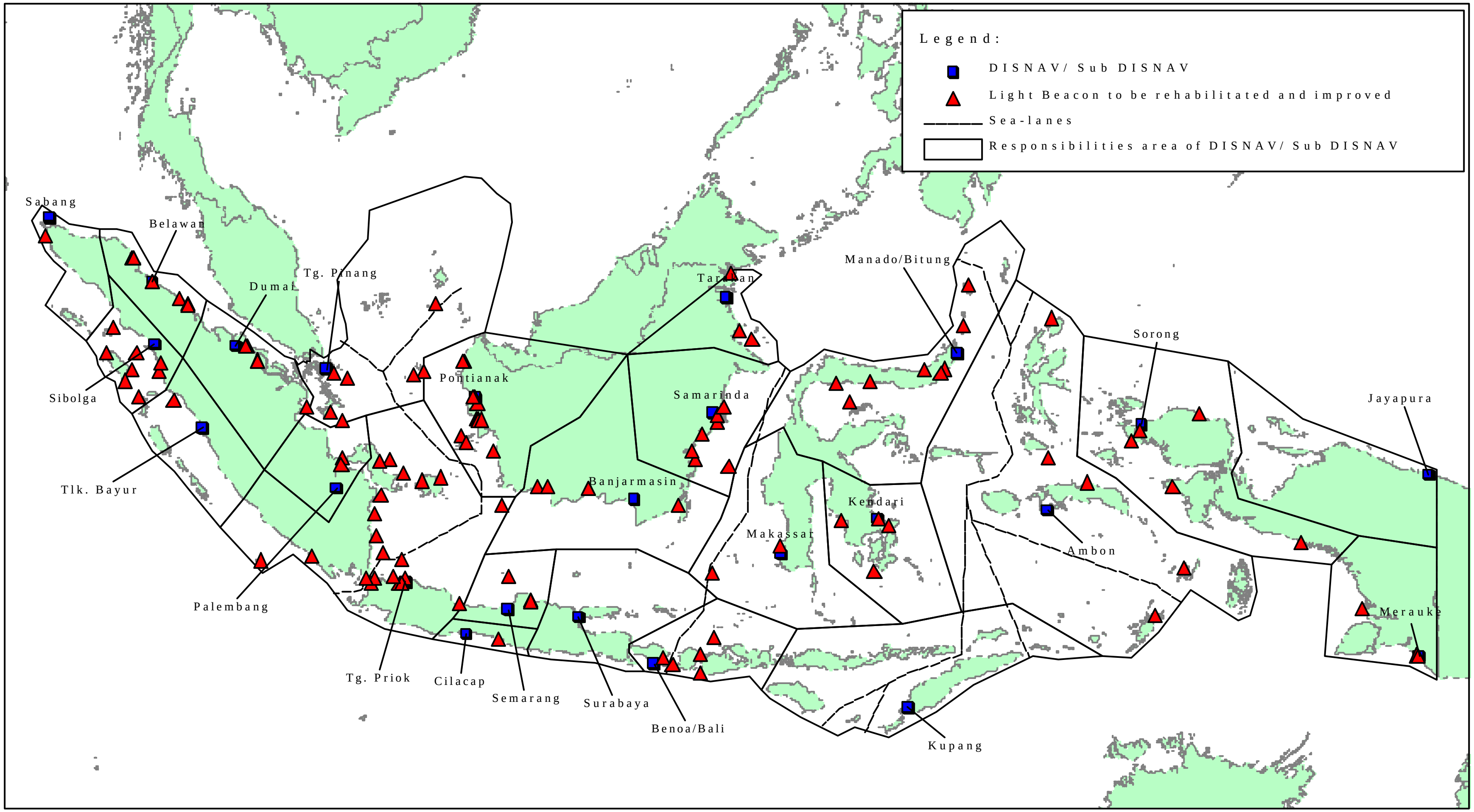


Figure 3.1.3. Location Map of Development of Lighthouse in Proposed Priority Projects

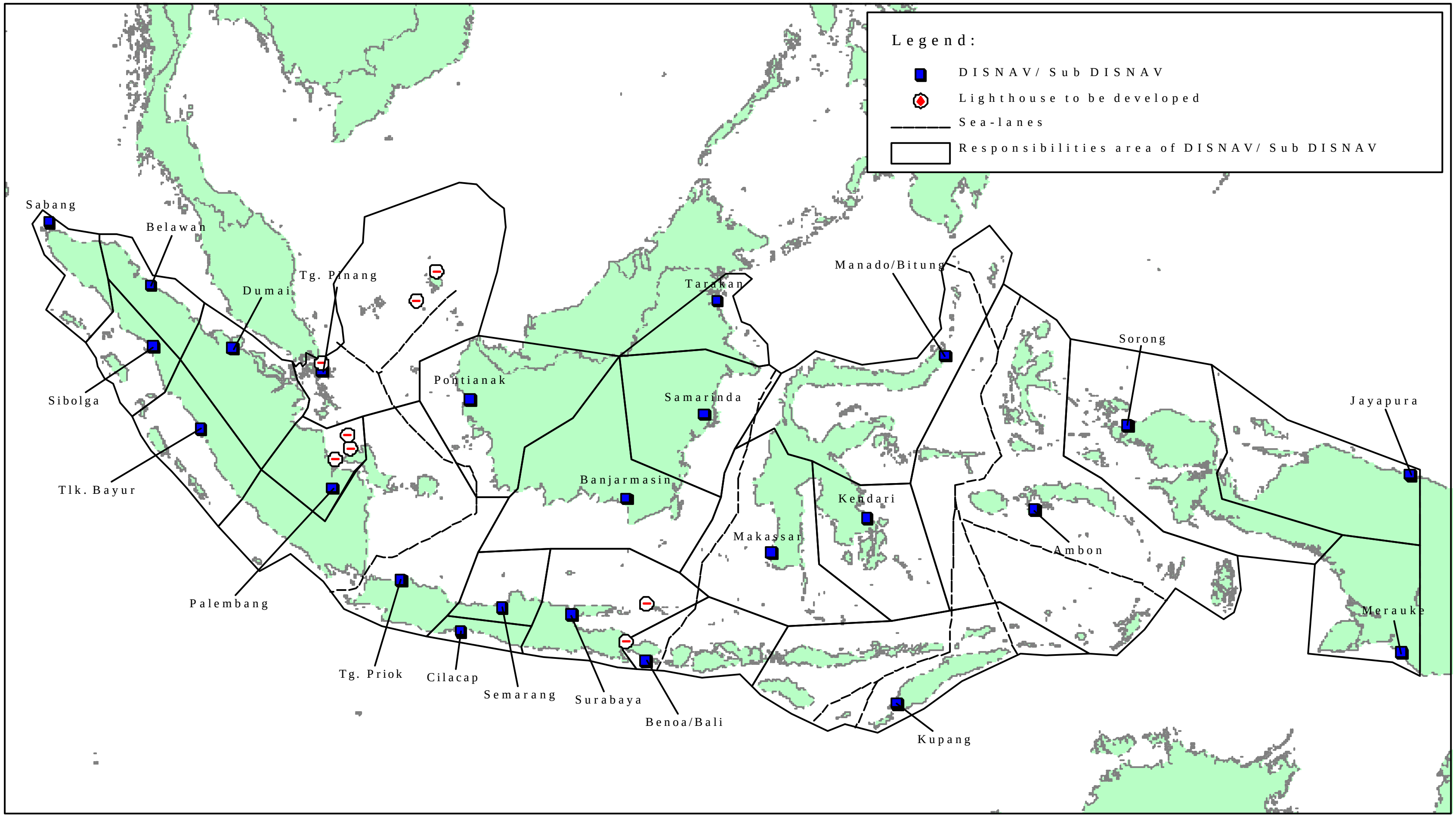
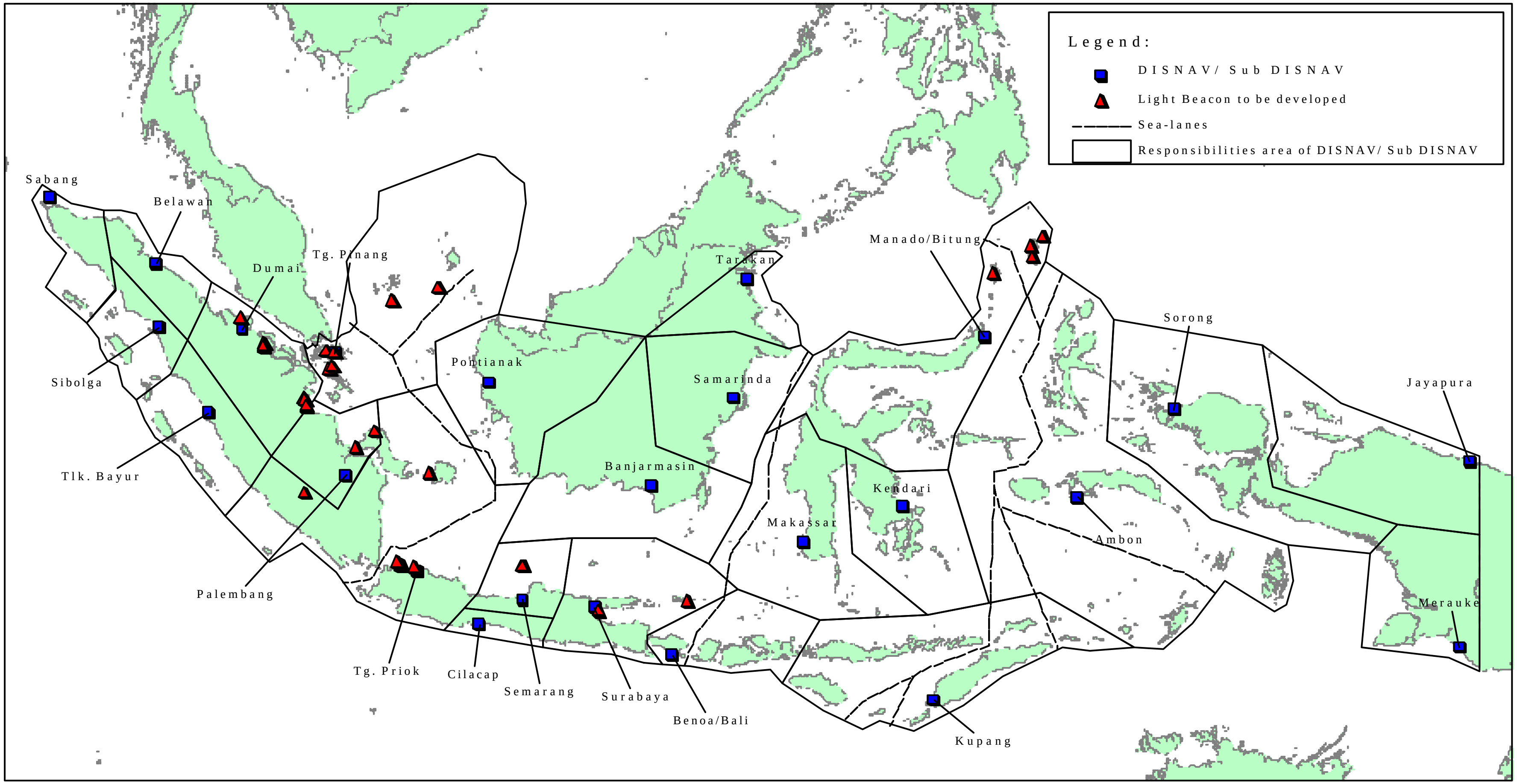


Figure 3.1.4. Location Map of Development of Light Beacon in Proposed Priority Projects



3.1.2. Supporting Facilities

Supporting facilities compries 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 is too old, so the earlier improvement is required In consideration of the above, proposed priority projects of supporting facilities are selected as shown in **Table 3.1.5.**

Table 3.1.5. Proposed Supporting Facilities for Priority Project

Item	Development	Rehabilitation	Improvement
Buoy Base	3 office		2 office
Open Storage	5 office		
Workshop			3 office
Storage			2 office

The development of buoy bases of the following three (3) DISNAVs is planned in the proposed priority project.

① DISNAV Tanjung Priok
② DISNAV Semarang
③ DISNAV Benoa

These three (3) DISNAVs have no space area to develop the buoy bases at present, so it is important to obtain the required area as soon as possible.

Two (2) buoy bases of the following DISNAVs are included in the improvement plan in the priority projects.

① DISNAV Tanjung Priok
② DISNAV Samarinda

Although the buoy base of Tanjung Priok has enough space, the land is submerged at high tide. The area of Samarinda buoy base is too small.

Development of open storage for buoy bodies of the following five (5) DISNAVs is included in the proposed priority projects.

① DISNAV Belawan
② DISNAV Tanjung Pinang
③ DISNAV Tlk Bayur
④ DISNAV Palembang
⑤ DISNAV Semarang

These DISNAVs have no space to store buoy bodies at present.

The improvements of workshops in the following four (4) DISNAVs are planned in the proposed priority projects.

① DISNAV Dumai
② DISNAV Palembang
③ DISNAV Surabya

④ DISNAV Samarinda

The areas of these workshops are insufficient for the work.

Machine tools, hand tools and other equipment of workshop equipment are too old and deficient.

The development of storage for the following two (2) DISNAVs is planned in the proposed Priority Projects.

① DISNAVTanjungPinang

② DISNAV Benoa

Storage of DISNAV Tanjung Pinang is too small, and DISNAV Benoa have no storage.

Implementation schedule for supporting facilities is shown in **Table 3.1.6.**

Table 3.1.6. Implementation Schedule for Supporting Facilities

	Phase	Master Plan										
		01	02	03	04	05	06	07	08	09	10	11
Workshop	Phase1											
Buoy Base	Phase1											

Estimate of project cost for supporting facilities consisting of workshop and buoy base is shown in **Table 3.1.7.**

Table 3.1.7. Estimated Cost for the Development and Improvement of Workshop and Buoy Base

Unit: Thousand US$

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

3.1.3. 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**".

3.2. 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 as described in **Section 1.2. of Main Report Part 2.**

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.

And, DGPS is necessary for the following reason:

- Maintenance of maritime safety in and around the waters of sea lanes, and Improvement of vessel traffic safety,
- Avoidance of serious marine pollutions such as oil spread by marine casualties,
- Decrease of major marine casualties such as grounding, collision and so forth,
- Decrease much human loss caused by major marine casualties such as grounding, collision, and sinking,
- Meeting international standards as a maritime country,
- Meeting new international standards and development of infrastructure.

The priority is given to Jakarta, Benoa and Makassar related to Sea Lanes Ⅰ and Ⅱ as strategic as specified in the Short Term Plan.

The locations of three (3) DGPS stations for proposed priority project are shown in **Table 3.2.1.**

Table 3.2.1. Locations of DGPS Transmitting Stations

Items	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

To manage and maintain accuracy of GPS and facilities, DGPS Monitoring Group should be established in Directorate of Navigation of DGSC in Jakarta.

The feasibility study on the followings was carried out for the selected three (3) locations and its related sites of the proposed Priority Project and the results are separately made on:

- Preliminary engineering design,
- Effectiveness of economical aspect, and,
- Cost estimate.

Project Cost is estimated as follows;

Table 3.2.2. Project Cost for Proposed Priority Project

Unit: Thousand US$

Description / Phase	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 report is bound in separate volume as titled **"FEASIBILITY STUDY REPORT: VOLUME II PART 2: Differential Global Positioning System (DGPS)"**.

3.3. VTS System

3.3.1. General

The Project sites of Short Term Plan are selected in Chapter 2.4. The priority project should be selected from the project sites for Short Term Plan. Names of the project sites are listed in **Table 3.3.1**.

Table 3.3.1. 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	

Feasibility Study is carried out for Priority project to complete the following works.

- Preliminary engineering design.
- Cost estimation.

3.3.2. Proposed Sites for Priority Project

VTS System is comprised of Remote station (Radar and/or AIS equipped) and Sub Center. We proposed Project sites listed in **Table 3.3.1.** as Priority project sites**.** Reasons of the selection are as follows:.

(1) Remote Station site:

① In case of Sunda Strait:

- A lot of cargo is transported by ferry from Sumatra to Jawa Island and vice versa,
- There is the 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 tourist come to Bali and Lombok Island from many countries, so that environmental condition should be protected for economical benefit from pollution caused by marine casualty.

Actual positions of remote stations will be proposed after the completion of the feasibility study work.

(2) Project site for Sub Center

Two (2) Sub Center should be provided to control Merak and Tanglad remote stations. We propose two (2) Sub Center in Sunda and Lombok Strait area because it is desirable that Sub Center should be established at adjacent area of remote station respectively.

Actual position of Sub Center will be proposed finally after completion of the feasibility study work.

3.3.3. Project Cost for Priority Project

Project cost is estimated as follows:

Table 3.3.2. Project Cost of Priority Project

Unit: Thousand US$

Description	Cost of Priority project	
	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

3.3.4. 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**".

3.4. GMDSS Expansion and Improvement

(1) Amendments to the 1974 SOLAS Convention concerning GMDSS, Chapter Ⅳ (Radio communications), Part B (Undertaking by Contracting Governments), Regulation 5 (Provision of radio Communication service) stipulates:

"Each Contracting Government undertakes to make available, as it deems practical and necessary either individual or in cooperation with other Contracting Government, appropriate shore-based facilities for space and terrestrial radio communication services having due regard to the recommendations of the organization"

And GMDSS was put into service in February 1992 and fully implemented in February 1999.

(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. The Republic of Indonesia, as a big maritime state in the world, has a vital responsibility for the establishment of maritime distress and safety telecommunication system in accordance with the SOLAS Convention and the related international regulations.

(3) A lot of human lives have been lost every year in Indonesian waters by serious marine accidents. The recent examples of accidents are as follows;

① On 29 June 2000, ferry boat "Cahaya Bahari" sank off Manado in Sulawesi island, in which the passengers and crews of more than 500 have been missing;

② A passenger ship "Restu Ilahi" which sank at the Makassar Strait on 27 May 2001 with 93 persons. 44 persons were rescued within 9 days, but 49 persons are still missing.

Above accidents, especially, pointed out the lack of maritime telecommunication system.

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.

It is pointed out that one of the reasons why the measures against piracy and armed robbery do not work effectively is the delay in information transmission.

IMO recommends all ship masters that if they are or may be involved in piracy and armed robbery, they should quickly report the fact to the nearest 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 engaged in transportation and fishing activities in Indonesian waters.

GMDSS provides many good effects and impacts on Indonesian social and economic activities as follows;

[GMDSS effects and impacts]

As for International Responsibilities as a Maritime State

Ensuring Rescue and Safety of Life

Rescue and Preservation of Ships and Property

Marine Environment Protection

Safety of sea lanes

As for Promotion of Economic Activities

(Direct)

Maritime Transportation

Fishery Activities

Exploitation of Ocean Resources

(Indirect)

Development of National Economy by Efficient Maritime Traffic

Promotion of Local Industries

Exploitation of Sea-bed Mines

Promotion of Shipping Industries

(6) GMDSS was developed with the aim that a vessel in distress 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 network, thereby notify the station list of GMDSS to International Maritime Organization (IMO), the following GMDSS expansion and improvement should be implemented as an urgent project;

- To cover major blind waters by MF DSC,
- To cover waters around main ports and important navigation waters by VHF

DSC,

- 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 since 2001, thereby the maintenance and training fee for the maritime telecommunication system has been substantially improved.

(8) Estimated costs for Proposed Priority Project of GMDSS expansion and improvement are showed in **Table 3.4.1.**

Table 3.4.1. Estimated Costs for Proposed Priority Project of 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 bound in separate volume as titled **"FEASIBILITY STUDY REPORT: VOLUME Ⅳ PART 4: GLOBAL MARITIME DISTRESS AND SAFETY SYSTEM (GMDSS)"**

3.5. Indonesia Ship Reporting System

(1) A Ship Reporting System provides up-to-date information on the movements of vessels in order to give a quick and maximum assistance by participating vessels to a vessel which may be in distress, and in order to facilitate a quick SAR operation in case of missing of a participating vessel.

A Ship Reporting System plays an important role in maritime search and rescue in conjunction with distress and safety communication system by GMDSS.

"International Convention on Maritime Search and Rescue, 1979" (SAR Convention) which has become effective since 1985 stipulates in Chapter 6 (Ship Reporting Systems);

"6.1.1 Parties should establish a ship reporting system for application within any search and rescue region for which they are responsible, where this is considered necessary to facilitate search and rescue operations and is deemed practicable."

(2) AMVER (Automated Mutual-assistance Vessel Rescue system), the Ship Reporting System of the United States has been operated since 1958, which has made significant achievements in saving human lives making history in this field.

Thereafter, the System has been established in many countries, for Asia-Pacific regions, AUSREP (Australia), JASREP (Japan), INSPIRES (India), STRAITREP (The Strait of Malacca and Singapore), KOSREP (Korea) and CHISREP (China), have started and contributed greatly 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 search and rescue but also preventing marine pollution, countermeasures against crimes at sea, etc.

Under these circumstances, International Maritime Organization (IMO) has adopted Resolution A.851 (20) "General Principles for Ship Reporting Systems and Ship Reporting Requirements, including Guidelines for Reporting Incidents involving Dangerous Goods, Harmful Substances and/or Marine Pollutants" in 1997.

After the simultaneous multi-terrorism in the Unite States on 11 September 2001, Japanese Government (Ministry of Land, Infrastructure and Transport, and Japan Coast Guard) is encouraging for expanded ship reporting, considering that there will be threat to ships such as terrorism and piracies.

(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 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.

In case of a passenger ship "Retsu Ilahi" sank at Makassar strait on 27 May 2001, 49 persons are still missing, and 44 persons were rescued in several times within 9 days. If a Ship Reporting System had been established, a lot of lives would have been rescued by nearby ships.

As Indonesian waters are blessed with moderate temperature and calm sea, persons thrown into the sea can live longer. Therefore, the introduction of a Ship Reporting System may greatly contribute to the rescue for those persons.

(7) Indonesia Ship Reporting System should have the vast reporting area to cover the whole Indonesian Search and Rescue Region (SRR).
As DGSC fortunately owns many coast stations throughout Indonesia, Indonesia Ship Reporting System can be established with less cost and within short term using these existing coast stations.
At the first stage,

- Existing DSC/NBDP at major coast stations (1^{st}, 2^{nd} and 3^{rd} 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 1^{st} and 2^{nd} class stations in order to adopt an automatic position-detecting system.

(8) Budget from the Light Dues has been allotted to DGSC since 2001, thereby the maintenance and training fee for the maritime telecommunication system have substantially been improved.

(9) Estimated costs for Proposed Priority Project of Ship Reporting System are showed in **Table 3.5.1.**

Table 3.5.1. Estimated Costs for Proposed Priority Project of 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 bound in separate volume as titled **"FEASIBILITY STUDY REPORT : VOLUME Ⅴ PART 5 : INDONESIA SHIP REPORTING SYSTEM"**

3.6. 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$88.820 million.**

The proposed Priority Projects summarized with implementation schedule and estimated project costs are shown in **Table 3.6.1.**

The site map of the Priority Projects for aids to navigation is shown in **Figure 3.6.1.** and that of telecommunications system is shown in **Figure 3.6.2.**
The proposed priority projects are summarized as shown in **Table 3.6.1**.

Table 3.6.1. Implementation Schedule and Cost for Proposed Priority Projects

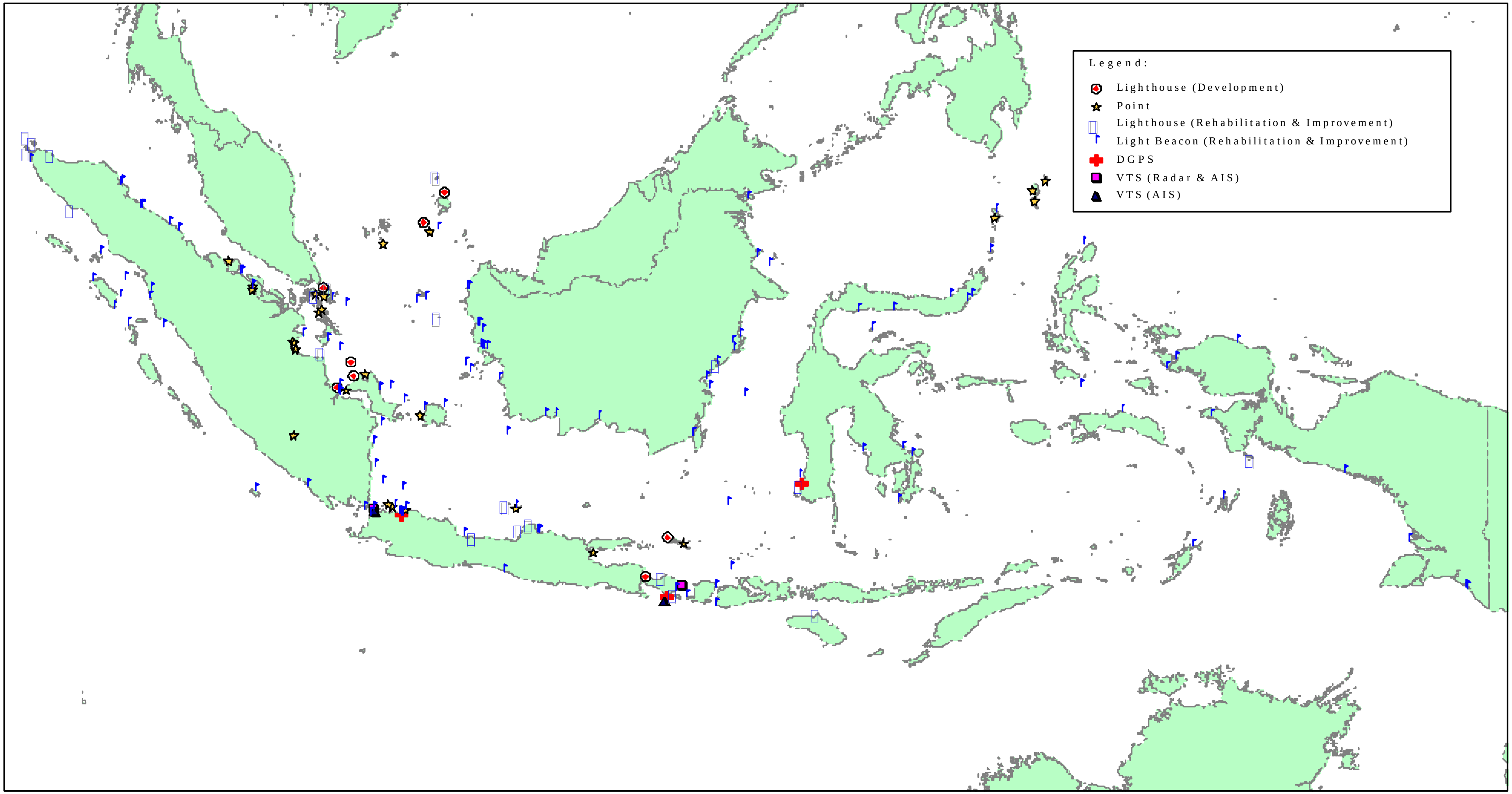
Unit: Million US$

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**	

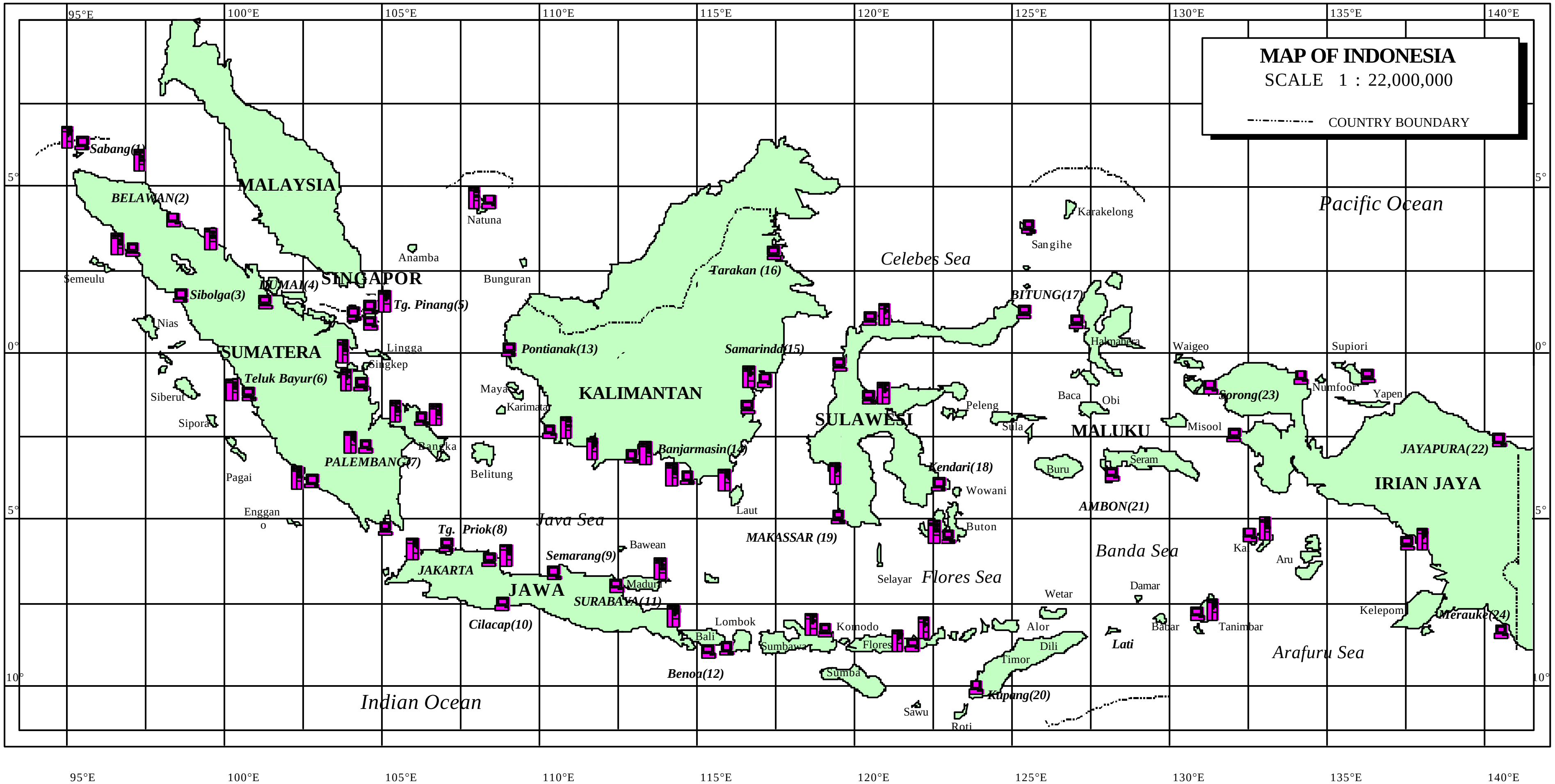
Implementation without Cost

Implementation with Cost

Figure 3.6.1. Location Map of Aids to Navigation Field on Proposed Priority Projects



F i g u r e 3 . 6 . 2 . L o c a t i o n M a p o f T e l e c o m m u n i c a t i o n S y s t e m F i e l d o n P r o p o s e d



LEGEND

GMDSS (Priority Project)

Ship Reporting System (Priority Project)

Name of city/town in map and the number in () shows the location of DISNAV and its number.

CHAPTER 4.

ENVIRONMENTAL ASSESSMENT

CHAPTER 4.
ENVIRONMENTAL ASSESSMENT

4.1. Background and Objectives

GOI is in need of the Master Plans of both fields of Aids to Navigation and Maritime Telecommunications System as the Maritime Traffic Safety System Development Plan, which covers up to the year 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.

DGSC is responsible for the environmental conservation on the execution of the Development Plan.

The objective of this environmental study is 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.

4.2. 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, consequently, the Act on Basic Provisions for the Management of the Living Environment (Act No.4 of 1982) was abolished. The Act No.23 of 1997 makes the principle of environmental management clear and serves as a basic indicator for other related legislation, which consists of 10 chapters, 52 articles concerned with principle, objectives, rights, obligations, society's roles, authorities, settlements, penalty and so on.

The Act No.23 specifies the following 6 objectives in Article 4:

① To achieve conformity, harmony, and balance between human-beings and the environment

② To instill in Indonesian citizens the need to protect and develop the environment

③ To guarantee the interest of present and future generations

④ To achieve the conservation of the environmental functions

⑤ To control wisely the utilization of potential resources

⑥ To protect the Unitary State of the Republic of Indonesia from the impacts of a work and/or an activity outside the State's territory which causes pollution and/or environmental damages

(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 completion of UKL and 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.

The followings are the points of each decree.

① Decree of the Minister of Communication No. KM4, 1996

a. This decree stipulates the compulsion for completion of UKL and UPL for the business plan or activity related to Sea Communication Sub-sector, based on the Government Regulation No.51 1993 about AMDAL.

b. This decree was stipulated in view of all concerned Laws, Government Regulations and other Decrees.

c. UKL is the effort to support environmental-friendly development for business plan or activity, for which the implementation of AMADEL is not comp ulsory but the environmental management should be compulsorily completed.

d. UPL is the effort to support environmental-friendly development for business plan or activity, for which the implementation of AMDEL is not compulsory but the environmental monitoring should be compulsorily completed.

e. Business plan or activity related to Sea Communication Sub-sector for which UKL and UPL are compulsory shall be determined based on the type of business or activity with the criteria of size, length, width, area, volume, capacity, depth, and service level, in accordance with the impact of business and activity by the type which should be necessarily coped with.

② Decree of the Minister of Communication No. KM5, 1996

a. This decree stipulates the technical manual for the implementation of UKL and UPL related to Sea Communication Sub-sector, considering the Decree of the State Minister for Environment No.KEP12/MENLH3/1994 concerning general guide to the composition of UKL and UPL for business plan/activity to which the implementation of AMDAL is not compulsory to complete but the environmental management and monitoring effort should be compulsorily completed.

b. This decree was stipulated in view of all concerned Laws, Government Regulations and other Decrees.

c. The flow charts of the composition and handling of UKL and UPL are shown in **Figure 4.2.1.** and **Figure 4.2.2.**

Figure 4.2.1. Rationalization Sequence of the Approach of Composition of UKL & UPL

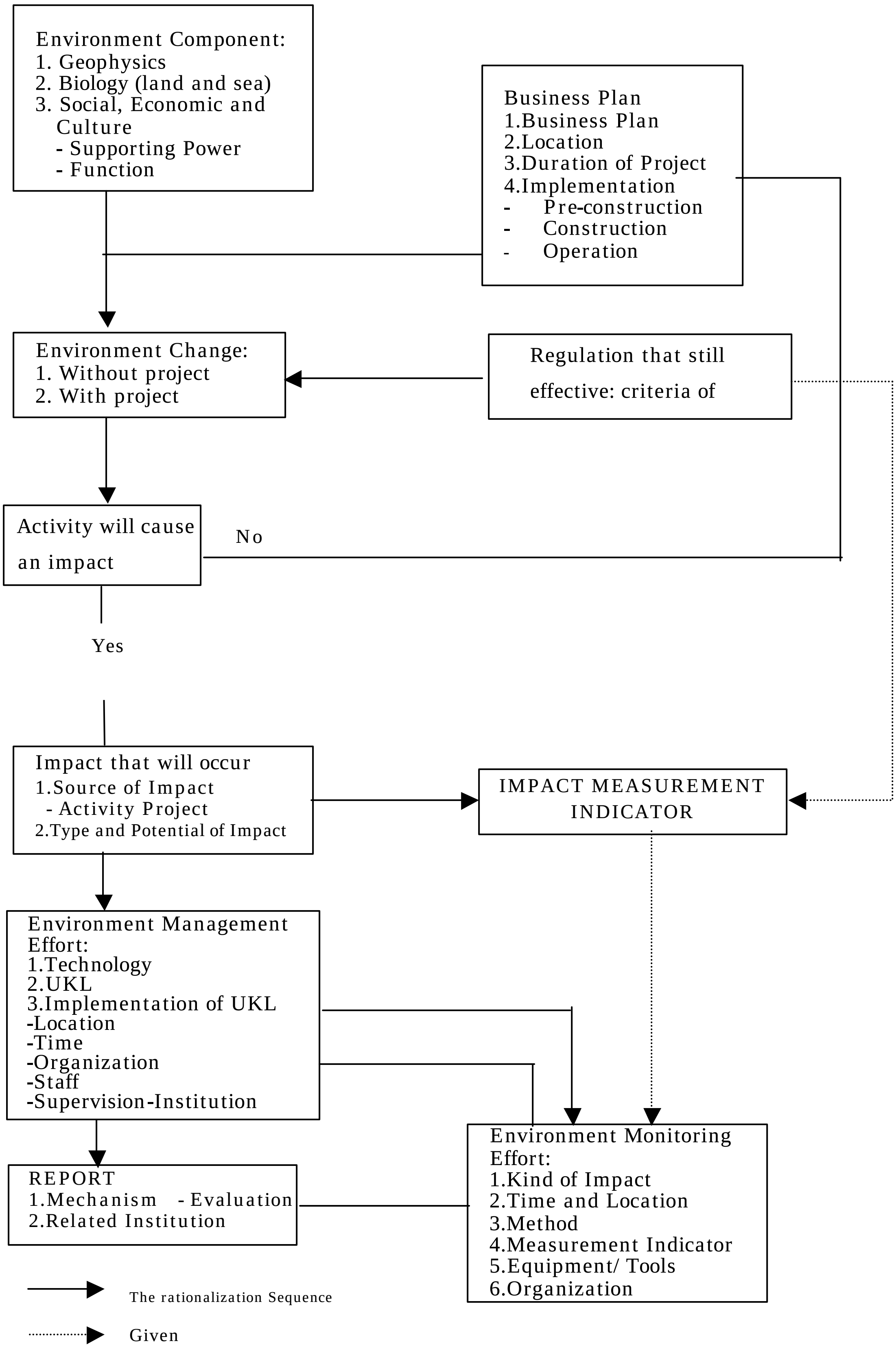
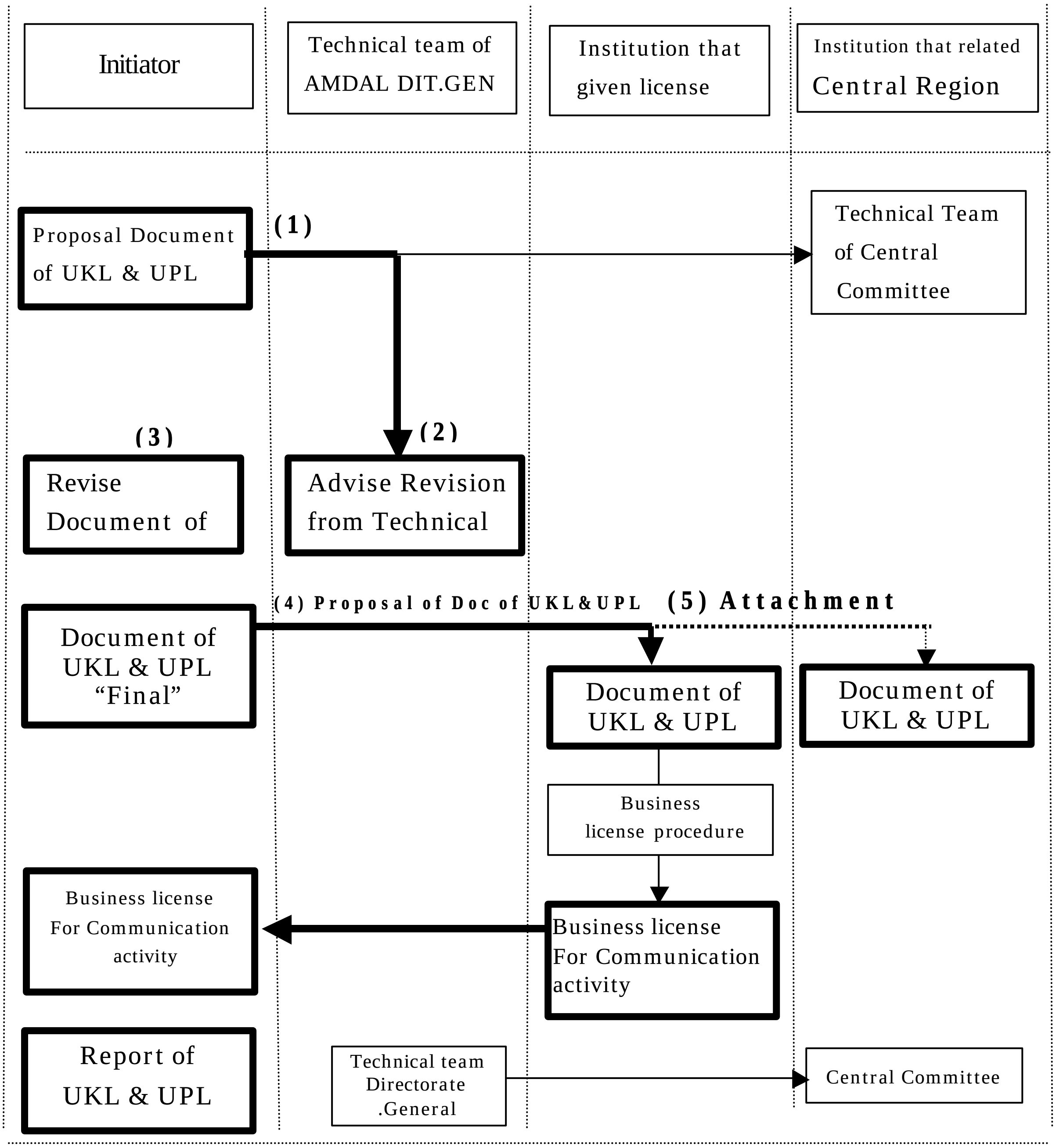
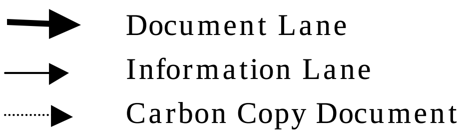


Figure 4.2.2. Procedure for Handling of UKL & UPL



Note : For activities which had gotten government agreement, Ministry of Communication please send the document to BKPM



4.3. Project Description

4.3.1. 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;
Details are explained in the Chapter 1 of this report.

(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, Satellite Telecom System
- ③ Utilization of Satellite System as Internal Communication
- ④ Integration of Coastal Radio Stations
- ⑤ Up-grading of DGSC Ship's Communication

(7) Improvement of aged equipments and facilities

4.3.2. 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;
Details are explained in the Chapter 3 of this report.

① Light House Sites

Table 4.3.1. Lighthouse Sites

	Location	Latitude (Decimal Degree)	Longitude (Decimal Degree)
1.	P. Timau	3.313889 N	107.561429 E
2.	Tg. Sading	1.202778 N	104.393333 E
3.	Memburit	6.845833 S	115.212000 E
4.	P. Menjangan	8.091667 S	114.525238 E

Area : 5000 m^2 with fencing

Housing : Living quarters for five (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

Table 4.3.2. VTS Radar Sites at Sunda Strait

Name (Island)	Position	Altitude	Access road
Merak (Jawa)	5 54' 35" S 106 00' 00" E	134m	1.000m

Table 4.3.3. VTS Radar Sites at Lombok Strait

Name (Island)	Position	Altitude	Access road
Tanglad (Nusa Penida)	8 46' 56" S 115 35' 40" E	420m	Village top, road and power line available

Tower height 20m

Leveling of site 1,200m^2

Equipment and Electric generator house 105m^2

4.4. 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...

4.5. Initial Environmental Examination (IEE)

IEE was conducted on 2 types of projects, one of them is the Master Plans on the Aids to Navigation and the Maritime Telecommunication System up to the target year of 2020, the other is the Priority Projects for the investigation of UKL and UPL selected from the Short Term Plans up to the target year of 2007.

4.5.1. 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 4.3.1. of this Chapter.

However, the following 5 projects are excluded from the targets of IEE because of each reason mentioned below:

① Radio Aids to Navigation

a. Radio Beacons

They are planned to install on existing coastal and offshore navigation aids. New constructions are not planned.

b. DGPS

The utilization of existing coastal radio stations is planned. Constructions of new building, antenna etc. are not planned.

② Supporting Facilities for Aids to Navigation

a. Building of Buoy Tender and a few other kinds of supporting vessels, and supplying of supporting facilities and equipment are planned.

b. No construction works are planned.

c. The utilization of existing buildings for supporting is planned.

③ GMDSS Expansion and Improvement

a. Installation of GMDSS equipment in existing coastal radio stations, and improvement of coastal radio stations for enabling to cover GMDSS are planned.

b. No construction works for buildings, antennas, etc. are planned.

④ Maritime Telecommunication Networks

a. Establishment of Ship Reporting System

Existing telecommunication facilities are planned to use.

b. Upgrading of Internal Communication Network

Upgrade of telecommunication facilities, communication network, etc. is planned. Constructions of new building, antenna etc. are not planned.

c. Utilization of Satellite System as Internal Communication

The utilization of existing facilities is planned.

d. Integration of Coastal Radio Stations

Improvement of the land network system of the coastal radio stations, etc. is planned.

⑤ Upgrading DGSC Ship's Communication

a. Upgrading of ship's telecommunication system, such as introduction of digital maritime telecommunication system is planned. Existing buildings, antennas and other facilities are planned to utilize.

b. Constructions of new building, antenna etc. are not planned.

(2) Target of IEE for the Master Plans

Consequently, it is concluded that the targets of IEE are 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.

③ The environmental components for conducting IEE are shown in the **Table 4.5.1.**

④ The environmental impacts to be covered in conducting IEE are shown in the **Table 4.5.2.**

Table 4.5.1. Description of Environmental Component

1. Land a. Status of Land; b. Utilization of land; c. Susceptible on natural disaster (earthquake, floods, slide); d. Chemical and physical quality and type of land (including the result of testing). **2. Source of water (water of surface and ground water)** a. Rate of flow (to water of surface and ground water) height of wave and ebb (to sea water); b. Allotment of the above; c. Distance with location plan activity; d. Chemical and physical quality (Including the test result of laboratory) that compare with quality of existing environment (as instruction letter of Governor/ Decree of Minister/ Government Regulation. **3. Air and Noise** a. Air quality and level noise both the source and/or surrounding of location plan activity according to dominant wind direction. Enclosure the result of testing laboratory. b. Climate Circumstance (climate data covering temperature, dampness, rainfall, wind and rain day. Special of wind that covers wind speed and direction expressed in table and "Wind Rose "monthly). **4. Flora and Fauna** a. Mentioning the type of flora and fauna both water and land, which are found in location and surrounding of location plan activity; b. Explaining whether rareness fauna and flora type that protected. **5. Social life, Economic Culture** Description as brief and clear of people condition around the location plan activity from aspect population (amount according to type, old, and the density), source of income, education level, earnings level, health condition, religion, mores, perception society, and discipline and security level. **6. Others** a. Description about the sensitive district / crisis that related to supporting environment (protected forest, preserve, cultural pledge, district of tourism, etc. b. Expression the regional space order general plan, where plan activity reside in.

Table 4.5.2. Type of Impacts to be Covered

1.Impact to Natural Resources a. Impact on coastal conservation (such: erosion, sedimentation); b. Impact on hydro oceanography (the changing of stream flow, Rise and fall of the tide; c. Impact on sea biology (mangrove, grass sea, coral).
2. Impact on Chemical Physical a. Source of Impact; b. Type and Potency of Impact; c. Characteristic and measurement of impact.
3. Impact on Biological a. Source of Impact; b. Type and Potency of Impact; c. Characteristic and measurement of impact.
4. Impact to Social, Economic and Culture a. Source of Impact; b. Type and Potency of Impact; c. Characteristic and measurement of impact.

(4) Result of IEE for Master Plan

Results of IEE for the Master Plans are shown in **Table 4.5.3.**

The bases of the evaluation are as follows;

a. Land

Construction of lighthouse needs 5,000 m^2 of land for each site and VTS radar site needs 1,200 m^2 for each site. There are problems of land expropriation.

b. Water

Quantity of waste and waste water, and overflow of solid waste are unknown.

c. Air and noise

Taking the scale of construction work and machinery used for construction work of lighthouse and radar site into account, it is anticipated small.

d. Flora and fauna

It is depend upon the condition of each site, many sites in the Master Plans, detailed survey should be done.

e. Social, economic and cultural component

There are problem of employment opportunities. Detailed survey should be done.

f. Others

There are many sites in the Master Plans, there are many unknown factors.

(5) Conclusion of IEE for Master Plans

The results of IEE for the Master Plans show that the occurrence of not significant impact is anticipated on 2 components and 5 components are unknown, therefore, it is concluded that the investigation of UKL and UPL on the Master Plans should be conducted.

Table 4.5.3. Result of IEE for the Master Plans

Environmental Component	Evalu -ation	Guide to Investigation
1. Land a. Status of Land; b. Utilization of land; c. Susceptibleness on natural disaster d. Chemical and physical quality and type of land	B	• Owner of land • Earthquake, tsunami, flood, slide
2. Water a. State of sea, fresh and waste water around the site b. Chemical physical quality d. Bacteria, plankton, benthos	C	• Measurement of Biochemical Oxygen Demand (BOD) and Suspended Solid (SS)
3. Air and Noise a. Air quality b. Source and level of noise surrounding of site b. Characteristic climate Circumstance	C	• Level of noise during construction work
4. Flora and fauna a. Type of flora and fauna both water and land, found in site and surrounding of site b. Existence of rare, valuable and protected flora and fauna	C	• Endangered species
5. Social, Economical and Cultural component a. Population of community (distribution and resident of the site) b. Source of income c. Education and earning level d. Religion and mores e. Perception society f. Discipline and security level g. Fishery activities h. Agricultural activities i. Existence of historical heritage j. Existence of cultural property k. Existence of topography and geography with special scientific value l. Existence of national park m. Existence of nature preserve	B	• Condition of people • Movement of fishing vessels • Necessity of resettlement
6. Others a. Sensitive district (protected forest, preserve, cultural pledge, district of tourism, etc.) b. Regional plan	C	• Beautiful scenery, etc. in the vicinity of the site

Evaluation ：A : Significant impact anticipated
B : Not significant impact anticipated
C : Unknown, necessary to investigate
D : No impact anticipated

4.5.2. IEE for Priority Projects

As mentioned above, the subjects of IEE for Priority Projects are 4 sites of lighthouse project and 2 sites of VTS project. listed in 4.3.2. of this Chapter. IEE for the selected 6 sites is conducted with the same method and procedure as IEE for the Master Plans.

(1) Details of selection of target sites for investigation

① Development and Rehabilitation of Visual Aids to Navigation

a. Because of rehabilitation of existing facilities, rehabilitation projects were excluded from the target.

b. Because of small scale of their civil work, development of Light Beacons and Light Buoys are also excluded from the target.

c. Based on general consideration about the location of each site, and consultation with counterpart, 4 target sites for development of lighthouses out of 13 planned sites of priority projects were selected as target sites for investigation, because it is considered that potential impacts of lighthouses development to the environment are similar and not significant.

d. 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 Sunda and Lombok radar sites of the Priority Project.

(2) Result of IEE for selected 6 sites

① Timau site

a. Results of IEE for Timau site

Results of IEE for Timau site are shown in **Table 4.5.4.**

The bases of the evaluation are as follows;

- Land

  The site is in virgin island, owned by local government. Small impact of land expropriation is anticipated.

- Water

  Quantity of waste and waste water, and overflow condition of solid waste are unknown.

- Air and noise

  No impact is anticipated because there is no inhabitant in this island.

- Flora and fauna

  Flora and fauna are not protected.

- Social, economic and cultural component

  A problem of employment opportunities for construction work is positive impact.

- Others

No impact is anticipated, but detailed survey shall be done..

b. Conclusion of IEE for Timau site

The results of IEE for the Timau site show that the occurrence of not significant impact for 1 component is anticipated and 5 components are unknown, therefore, it is considered that the investigation of UKL and UPL for this site should be conducted.

Table 4.5.4. Result of IEE for the Priority Projects (Site : Timau)

Environmental Component	Evalu-ation	Guide to Investigation
1. Land a. Status of Land; b. Utilization of land; c. Susceptibleness on natural disaster d. Chemical and physical quality and type of land	B	• Owner of land • Earthquake, tsunami, flood, slide
2. Water a. State of sea, fresh and waste water around the site b. Chemical physical quality d. Bacteria, plankton, benthos	C	• Measurement of Biochemical Oxygen Demand (BOD) and Suspended Solid (SS)
3. Air and Noise a. Air quality b. Source and level of noise surrounding of site b. Characteristic climate Circumstance	C	• Level of noise during construction work
4. Flora and fauna a. Type of flora and fauna both water and land, found in site and surrounding of site b. Existence of rare, valuable and protected flora and fauna	C	• Endangered species
5. Social, Economical and Cultural component a. Population of community (distribution and resident of the site) b. Source of income c. Education and earning level d. Religion and mores e. Perception society f. Discipline and security level g. Fishery activities h. Agricultural activities i. Existence of historical heritage j. Existence of cultural property k. Existence of topography and geography with special scientific value l. Existence of national park m. Existence of nature preserve	B	• Condition of people • Movement of fishing vessels • Necessity of resettlment
6. Others a. Sensitive district (protected forest, preserve, cultural pledge, district of tourism, etc.) b. Regional plan	C	• Beautiful scenery, etc. in the vicinity of the site

Evaluation : A : Significant impact anticipated
B : Not significant impact anticipated
C : Unknown, necessary to investigate

② Sading site

a. Result of IEE for Sading site

Results of IEE for Sading site are shown in **Table 4.5.5.**

The bases of the evaluation are as follows;

- Land

  Since the site is owned by Bintan International Resort Co., small impact of land expropriation is anticipated.

- Water

  Quantity of waste and waste water, and overflow condition of solid waste are unknown.

- Air and noise

  It is anticipated very small because there is no inhabitant around the site.

- Flora and fauna

  The site is in a resort plan, therefore impacts to flora and fauna will be anticipated small.

- Social, economic and cultural components

  A problem of employment opportunities for construction work is positive impact.

- Others

  No impact is anticipated, but unknown.

b. Conclusion of IEE for Sading site

The results of IEE for the Sading site show that the occurrence of not significant impact for 2 components is anticipated and 4 components are unknown, therefore, it is considered that the investigation of UKL and UPL for this site should be conducted.

Table 4.5.5. Result of IEE for the Priority Projects (Site : Sading)

Environmental Component	Evalu -ation	Guide to Investigation
1. Land a. Status of Land; b. Utilization of land; c. Susceptibleness on natural disaster d. Chemical and physical quality and type of land	B	• Owner of land • Earthquake, tsunami, flood, slide
2. Water a. State of sea, fresh and waste water around the site b. Chemical physical quality d. Bacteria, plankton, benthos	C	• Measurement of Biochemical Oxygen Demand (BOD) and Suspended Solid (SS)
3.Air and Noise a. Air quality b. Source and level of noise surrounding of site b. Characteristic climate Circumstance	C	• Level of noise during construction work
4. Flora and fauna a. Type of flora and fauna both water and land, found in site and surrounding of site b. Existence of rare, valuable and protected flora and fauna	C	• Endangered species
5. Social, Economical and Cultural component a. Population of community (distribution and resident of the site) b. Source of income c. Education and earning level d. Religion and mores e. Perception society f. Discipline and security level g. Fishery activities h. Agricultural activities i. Existence of historical heritage j. Existence of cultural property k. Existence of topography and geography with special scientific value l. Existence of national park m. Existence of nature preserve	B	• Condition of people • Movement of fishing vessels • Necessity of r esettlement
6. Others a. Sensitive district (protected forest, preserve, cultural pledge, district of tourism, etc.) b. Regional plan	C	• Beautiful scenery, etc. ir the vicinity of the site

Evaluation : A : Significant impact anticipated
B : Not significant impact anticipated
C : Unknown, necessary to investigate
D : No impact anticipated

③ Memburit site

a. Result of IEE for Master Plan

Results of IEE for the Membrit site are shown in **Table 4.5.3.**

The bases of the evaluation are as follows;

- Land

  Since the site is dry field used for farmland and owned by local people, there are problems of land expropriation.
- Water

  Quantity of waste and waste water, and overflow of solid waste are unknown.
- Air and noise

  Impact is anticipated very small because the site is in farmland.
- Flora and fauna

  The site is in farmland, therefore impacts will be small.
- Social, economic and cultural component

  A problem of employment opportunities for construction work is positive impact.
- Others

  No impact is anticipated, but detailed survey shall be done..

b. Conclusion of IEE for Membrit site

The results of IEE for the Membrit site show that the occurrence of not significant impact for 1 components is anticipated and 5 components are unknown, therefore, it is considered that the investigation of UKL and UPL for this site should be conducted.

Table 4.5.6. Result of IEE for the Priority Projects (Site : Membu rit)

Environmental Component	Evalu -ation	Guide to Investigation
1. Land a. Status of Land; b. Utilization of land; c. Susceptibleness on natural disaster d. Chemical and physical quality and type of land	B	• Owner of land • Earthquake, tsunami, flood, slide
2. Water a. State of sea, fresh and waste water around the site b. Chemical physical quality d. Bacteria, plankton, benthos	C	• Measurement of Biochemical Oxygen Demand (BOD) and Suspended Solid (SS)
3. Air and Noise a. Air quality b. Source and level of noise surrounding of site b. Characteristic climate Circumstance	C	• Level of noise during construction work
4. Flora and fauna a. Type of flora and fauna both water and land, found in site and surrounding of site b. Existence of rare, valuable and protected flora and fauna	C	• Endangered species
5. Social, Economical and Cultural component a. Population of community (distribution and resident of the site) b. Source of income c. Education and earning level d. Religion and mores e. Perception society f. Discipline and security level g. Fishery activities h. Agricultural activities i. Existence of historical heritage j. Existence of cultural property k. Existence of topography and geography with special scientific value l. Existence of national park m. Existence of nature preserve	B	• Condition of people • Movement of fishing vessels • Necessity of resettlement
6. Others a. Sensitive district (protected forest, preserve, cultural pledge, district of tourism, etc.) b. Regional plan	C	• Beautiful scenery, etc. in the vicinity of the site

Evaluation : A : Significant impact anticipated
B : Not significant impact anticipated
C : Unknown, necessary to investigate
D : No impact anticipated

④ Menjangan site

a. Results of IEE for Menjangan site

Results of IEE for the Menjangansite are shown in **Table 4.5.7.**

The bases of the evaluation are as follows;

- Land

  Menjangan Island is Natural Conservation area owned by local government. There are no inhabitant. Impact of land expropriation is anticipated small.
- Water

  Quantity of waste and waste water, and overflow of solid waste are unknown, detailed survey shall be done.
- Air and noise

  An impact for protected animals during construction work is anticipated, detailed survey shall be done.
- Flora and fauna

  There are protected flora and fauna in the island,detailed survey should be done.
- Social, economic and cultural component

  A problem of employment opportunities for construction work is positive impact
- Others

  Unknown but no significant impact is anticipated.

b. The results of IEE for Menjangan site show that the occurrence of not significant impact for 4 components is anticipated and 2 components are unknown, therefore, it is considered that the study of UKL and UPL for this site should be conducted.

Table 4.5.7. Result of IEE for the Priority Projects (Site : Menjangan)

Environmental Component	Evalu -ation	Guide to Investigation
1. Land a. Status of Land; b. Utilization of land; c. Susceptibleness on natural disaster d. Chemical and physical quality and type of land	B	• Owner of land • Earthquake, tsunami, flood, slide
2. Water a. State of sea, fresh and waste water around the site b. Chemical physical quality d. Bacteria, plankton, benthos	C	• Measurement of Biochemical Oxygen Demand (BOD) and Suspended Solid (SS)
3. Air and Noise a. Air quality b. Source and level of noise surrounding of site b. Characteristic climate Circumstance	B	• Level of noise during construction work
4. Flora and fauna a. Type of flora and fauna both water and land, found in site and surrounding of site b. Existence of rare, valuable and protected flora and fauna	B	• Endangered species
5. Social, Economical and Cultural component a. Population of community (distribution and resident of the site) b. Source of income c. Education and earning level d. Religion and mores e. Perception society f. Discipline and security level g. Fishery activities h. Agricultural activities i. Existence of historical heritage j. Existence of cultural property k. Existence of topography and geography with special scientific value l. Existence of national park m. Existence of nature preserve	B	• Condition of people • Movement of fishing vessels • Necessity of resettlement
6. Others a. Sensitive district (protected forest, preserve, cultural pledge, district of tourism, etc.) b. Regional plan	C	• Beautiful scenery, etc. in the vicinity of the site

Evaluation : A : Significant impact anticipated
B : Not significant impact anticipated
C : Unknown, necessary to investigate
D : No impact anticipated

⑤ Merak site

a. Results of IEE for Merak

Results of IEE for Merak site are shown in **Table 4.5.8.**

The bases of the evaluation are as follows;

- Land

  The site is in farmland owned by local people. There are problems of land expropriation.

- Water

  Quantity of waste and waste water, and overflow of solid waste are unknown.

- Air and noise

  It is anticipated negligible because the site is in the farm land..

- Flora and fauna

  Since the site is in farmland, no impact is anticipated.

- Social, economic and cultural component

  A problem of employment opportunities for construction work is positive impact..

- Others

  Unknown but impacts are anticipated small.

b. The results of IEE for Merak site show that the occurrence of not significant impact for 2 component is anticipated and 4 components are unknown, therefore, it is considered that the investigation of UKL and UPL for this site should be conducted.

Table 4.5.8. Result of IEE for the Priority Projects (Site : Merak)

Environmental Component	Evalu-ation	Guide to Investigation
1. Land a. Status of Land; b. Utilization of land; c. Susceptibleness on natural disaster d. Chemical and physical quality and type of land	B	• Owner of land • Earthquake, tsunami, flood, slide
2.Water a. State of sea, fresh and waste water around the site b. Chemical physical quality d. Bacteria, plankton, benthos	C	• Measurement of Biochemical Oxygen Demand (BOD) and Suspended Solid (SS)
3.Air and Noise a. Air quality b. Source and level of noise surrounding of site b. Characteristic climate Circumstance	C	• Level of noise during construction work
4. Flora and fauna a. Type of flora and fauna both water and land, found in site and surrounding of site b. Existence of rare, valuable and protected flora and fauna	C	• Endangered species
5. Social, Economical and Cultural component a. Population of community (distribution and resident of the site) b. Source of income c. Education and earning level d. Religion and mores e. Perception society f. Discipline and security level g. Fishery activities h. Agricultural activities i. Existence of historical heritage j. Existence of cultural property k. Existence of topography and geography with special scientific value l. Existence of national park m. Existence of nature preserve	B	• Condition of people • Movement of fishing vessels • Necessity of resettlement
6. Others a. Sensitive district (protected forest, preserve, cultural pledge, district of tourism, etc.) b. Regional plan	C	• Beautiful scenery, etc. in the vicinity of the site

Evaluation : A : Significant impact anticipated
B : Not significant impact anticipated
C : Unknown, necessary to investigate
D : No impact anticipated

⑥ Tanglad site

a. Result of IEE for Tanglad site

Results of IEE for the Master Plans are shown in **Table 4.5.9.**

The bases of the evaluation are as follows;

- Land

  The site is on top of hill owned by local people. There are problems of land expropriation.
- Water

  Quantity of waste and waste water, and overflow of solid waste are unknown.
- Air and noise

  Since the site is in dry field, the impact is anticipated negligible.
- Flora and fauna

  Also, the site is in dry field, no impact is anticipated.
- Social, economic and cultural component

  A problem of employment opportunities is positive impact. Detailed survey should be done.
- Others

  Unknown but no impact is anticipated.

b.Conclusion of IEE for Tanglad site

The results of IEE for Tanglad site show that the occurrence of not significant impact for 2 components is anticipated and 4 components are unknown, therefore, it is considered that the investigation of UKL and UPL for this site should be conducted.

Table 4.5.9. Result of IEE for the Priority Projects (Site : Tanglad)

Environmental Component	Evalu-ation	Guide to Investigation
1. Land a. Status of Land; b. Utilization of land; c. Susceptibleness on natural disaster d. Chemical and physical quality and type of land	B	• Owner of land • Earthquake, tsunami, flood, slide
4. Water a. State of sea, fresh and waste water around the site b. Chemical physical quality d. Bacteria, plankton, benthos	C	• Measurement of Biochemical Oxygen Demand (BOD) and Suspended Solid (SS)
5. Air and Noise a. Air quality b. Source and level of noise surrounding of site b. Characteristic climate Circumstance	C	• Level of noise during construction work
4. Flora and fauna a. Type of flora and fauna both water and land, found in site and surrounding of site b. Existence of rare, valuable and protected flora and fauna	C	• Endangered species
5. Social, Economical and Cultural component a. Population of community (distribution and resident of the site) b. Source of income c. Education and earning level d. Religion and mores e. Perception society f. Discipline and security level g. Fishery activities h. Agricultural activities i. Existence of historical heritage j. Existence of cultural property k. Existence of topography and geography with special scientific value l. Existence of national park m. Existence of nature preserve	B	• Condition of people • Movement of fishing vessels • Necessity of resettlement
6. Others a. Sensitive district (protected forest, preserve, cultural pledge, district of tourism, etc.) b. Regional plan	C	• Beautiful scenery, etc. in the vicinity of the site

Evaluation :
A : Significant impact anticipated
B : Not significant impact anticipated
C : Unknown, necessary to investigate
D : No impact anticipated

(3) Summary of IEE

Results of IEE are summarized as **Table 4.5.10**.

Table 4.5.10. 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, economic 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

No significant impacts on land expropriation and employment opportunity of local people for construction work are anticipated to the Master Plan and 5 selected sites, and no significant impacts on flora and fauna are anticipated to Menjangan site.

(4) 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

4.6 Investigation of UKL and UPL for Priority Projects

As mentioned above, the subjects of the investigation of UKL and UPL are 4 sites for development of lighthouse and 2 sites for VTS radar sites selected from the Priority Projects.

4.6.1. 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 of the Aids to Navigation to them.

4.6.2. 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. Status of land
b. Utilization of land
c. Susceptible natural disaster (Earthquake, Tsunami, Flood, Slide)
d. Chemical and physical quality of land

② Water

a. Chemical and physical quality of water (measurement of BOD and SS)
b. Bacteriological, plankton, benthos examination

③ Noise

a. Level of noise

④ Flora and Fauna

a. Type of flora and fauna both water and land, found in sites and surrounding of sites
b. Natural growth of valuable protected plants

⑤ Social, Economic, Cultural Life

a. Population of community
- Distribution of population
- Resident population of the site
- Source of income

b. Fishery activities
c. Agricultural activities
d. Existence of historical heritage

e. Existence of cultural property

f. Existence of topography and geography with special scientific value

g. Existence of national park

h. 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.

4.6.3. Present Environmental Conditions

The results of survey conducted for present environmental conditions on the 6 sites (P. Timau, Tg. Sading, Membrit, Menjangan, Merak and Tanglad) are as follows:

(1) P.Timau

Timau Island

District	West Bunguran
Regency	Natuna
Province	Riau

① Land

a. Geography

The site is in Timau Island, it is 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 Climate

According to climatic data released in 1998-2000 by Meteorological and Geographic Agency, Natuna Regency, the highest rainfall occurs in January and May (270mm), the lowest rainfall occurs in February and March (136.5mm). Average rainy day is 5 days/month. Maximum rainy days occur in January (27days). Minimum rainy days happen in February (4days). Average temperature is 29degrees Celsius, average wind speed is 2.5 m/sec..

Other general climatic conditions of this district are shown in the Chapter 2 of volume 1.

③ Chemical and Physical components

a. Air quality and noise

Results of air quality analysis (3 hours method, same as national standard) with national quality standard and noise level measurement around the site, based on the result of field survey, are shown in **Appendix 4.6.1.** and **Appendix 4.6.2.**

As shown in appendix, for example, measured values of CO (360$\mu g/m^3$) and Nox (1.04$\mu g/m^3$) are very low than national quality standard (10,000 and 150 each).

b. Soil quality

Soil fertility in Timau Island is classified as medium.

Results of laboratory analysis regarding soil fertility around the site are shown in **Appendix 4.6.3.**

As shown in appendix, soil quality is acidity (pH 5.3~6.2, H_2O).

c. Quality of ground water

There is no well water in this island.

d. Seawater quality

Depth of seawater around the site is about 10m.

The result of seawater quality analysis with national quality standard is shown in **Appendix .4.6.4.**

As shown in appendix, for example, measured values of BOD (4.6mg/l) and SS (2mg/l) are much lower than national quality standard (45 and 80 each).

④ Biological components

a. Flora

The type of flora that grow in the island are nipah, waru, api-api, cemara laut etc.. There is no protected flora in this island.

b. Fauna

Fauna that found in the island are. grasshopper, biawak, camar, elang laut, perkutut, etc.. There is no protected fauna in this island.

c. Aquatic biota

- Coral reef

  Marked coral colony is not found around the site.

- Fish

  Kerapu, common fish in this district, is found plenty around the site. No special kind of fish is reported in this area.

- Plankton and Benthos

  The result of aquatic biology analysis is shown in **Appendix 4.6.5.** There is no national standard for plankton and benthos in seawater in Indonesia, however, for example, very small number of zooplankton (2~30) is measured.

⑤ Cultural, Social and Economic Components

a. Demography and workforce

There is no inhabitant in this island and no need to carry out the resettlement of people.

According to Bunguran District in Numbers 2000, there are 18,410 inhabitants in West Bunuran District, average density was 18 persons / km^2. There was 59% productive age inhabitant.

b. Occupation

Inhabitants in West Bunuran District mostly work as farmers and as fishermen with low incomes.

c. Culture of Society

Native people of West Bunuran District are Melayu tribe. Majority of people are Moslems, therefore local culture and customs are much influenced by Islamic culture.

There is a special leadership system in this district.

Paternalistic leadership system is commonly found in homogenous society in most villages. It means that someone respected and honored is established either as formal leader (Village Head) or as Chief of Village Representative Body, and simultaneously as non-formal leader who handle social problems in the society. Usually, anything ordered by Village Head and Chief of Village Representative Body will be obeyed by the people.

No historical heritage or sacred places are found in Timau island..

d. Health of the society

Health facilities in West Bunuran District consist of 1 public health center and 8 supplementary public health centers.

e. People's perception

Results of questionnaires for people of West Bunuran District indicate that they do not know about Timau island and lighthouse. However, they do not mind if a new lighthouse is constructed in Timau island.

(2) Tg. Sading

Village	Lebong Sagoi
District	North Bintan
Keprauan	Riau
Province	Riau

① Land

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

The site is in hilly, rocky and bushy area, there is no inhabitant, but this area is owned by Bintan International Resort Co. owned by Slim Group. This area will be used as Bintan International Resort.

② Climate

Climatic data released in 1998-2000 by Meteorological and Geographic Agency, Sumenp Regency, states that the highest rainfall occurs in January, October and December (447mm), the lowest rainfall occurs in February and July (91.45mm). Average rainy day is 17.4 days/month. Maximum rainy days occur in October (25days). Minimum rainy days happen in July (7days). Average temperature is 30.1degrees Celsius, average wind speed is 2.6 m/sec. Other general climatic conditions of this district are shown in chapter 2 of volume 1.

③ Chemical and Physical component

a. Air quality and noise

Results of air quality analysis (3 hours method, same as national standard) with national quality standard and noise level measurement around the site, based on the result of field survey, are shown in **Appendix 4.6.6.** and **Appendix 4.6.7.**

As shown in appendix, for example, measured values of CO (36$\mu g/m^3$) and NOx (3.04$\mu g/m^3$) are very low than national quality standard (10,000 and 150 each).

b. Soil quality

Soil fertility in Sading is classified as medium.

Results of laboratory analysis regarding soil fertility around the site are shown in **Appendix 4.6.8.**

As shown in appendix, soil quality is strong acidity (pH 4.8~5.1 ,H_2O).

c. Quality of ground water

As mentioned above, the site is in hilly and rocky area, there is no ground water.

d. Seawater quality

The result of seawater quality analysis with national quality standard is shown in **Appendix 4.6.9.**

As shown in appendix, for example, measured values of BOD (6.8~8.0mg/l) and SS (3~4mg/l) are much lower than national quality standard (45 and 80 each).

④ Biological components

a. Flora

Types of flora in this area are nipah, api-api, bakau, etc. There is no protected flora in this district..

b. Fauna

Types of animals found in this area are belibis, kuntut, kucing, titik, etc.. There is no protected fauna in this district..

c. Aquatic biota

- Coral reef

  Marked coral colony is not found around the site.
- Fish

  Many kinds of common fish are found plenty around the site. No special kind of fish is reported in this area.
- Plankton and Benthos

  The result of aquatic biology analysis is shown in **Appendix 4.6.10.** There is no national standard for plankton and benthos in seawater in Indonesia, however, for example, number of zooplankton (8~35) is very small.

⑤ Cultural, Social and Economic Component

a. Demography and workforce

According to North Bintan District in Numbers 2000, there are 40,211 inhabitants in North Bintan District, average density was 392 persons / km2. There was 61.2% productive age inhabitant.

As mentioned above, there is no inhabitant around the site, there is no possibility of resettlement.

b. Occupation

Lebong Sagoi Village is not inhabited.

c. Land usage

As mentioned above, this area will be used as Bintan International Risort.

d. Culture of Society

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.

There is a special leadership system in this district.

Paternalistic leadership system is commonly found in homogenous society in most villages. It means that someone respected and honored is established either as formal leader (Village Head) or as Chief of Village Representative Body, and simultaneously as non-formal leader who handle social problems in the society. Usually, anything ordered by Village Head and Chief of Village Representative Body will be obeyed by the people.

No historical heritage or sacred places are found in North Bintan District..

e. Health of the society

Health facilities in North Bintan District District consist of 2 public health center and 11 supplementary public health center.

f. People's perception

Based on the interview with people of North Bintan District, they know the detail of lighthouse, but they did not give their opinion. Local people have no interest on the construction of lighthouse.

They expect that they could be recruited to work in the project according to their qualifications.

(3) Memburit

Memburit Island,

Village	Kali Sangka
District	Aljasa,
Regency	Sumenep,
Province	East Java

① Land

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.

Land usage by type of usage at the site is shown in **Appendix 4.6.11.**

② Climate

According to climatic data released in 1998-2000 by Meteorological and Geographic Agency, Sumenp Regency, the highest rainfall occurs in January and December (192.3mm), the lowest rainfall occurs in June, July , August and September (0mm). Average rainy day is 10 days/month. Maximum rainy days occur in January (27days). Minimum rainy days happen in August (1day). Average temperature is 31degrees Celsius, average wind speed is 2m/sec..

Other general climatic conditions of this district are shown in chapter 2 of volume 1.

③ Chemical and Physical components

a. Air quality and noise

Results of air quality analysis (3 hours method, same as national standard) with national quality standard and noise level measurement around the site, based on the result of field survey, are shown in **Appendix 4.6.12**. and **Appendix 4.6.13**.

As shown in appendix, for example, measured values of CO (216μg/m3) and NOx (4.11μg/m3) are much lower than national quality standard (10,000 and 150 each).

b. Soil quality

Soil fertility in Membrit Island is classified as medium.

Results of laboratory analysis regarding soil fertility around the site are shown in **Appendix 4.6.14**.

As shown in appendix, soil quality is strong acidity (pH 5.1~6.0,H_2O).

c. Quality of ground water

The result of the analysis of the ground water sample taken at the closest residential area to the site with national quality standard is shown in **Appendix 4.6.15**.

As shown in appendix, all parameters, except pH 6.1 (National standard 6.5~9.0) fulfill the condition of national quality standard.

d. Seawater quality

Depth of seawater around the site is 46m at most.

The result of seawater quality analysis with national quality standard is shown in **Appendix 4.6.16**.

As shown in appendix, for example, measured values of BOD (35mg/l) and SS (7mg/l) are much lower than national quality standard (45 and 80 each).

④ Biological component

a. Flora

The site is in the middle of dry field, used as farmland for rice and corn. There is no natural vegetation around the site.

b. Fauna

Also, the site is in the middle of farmland, there are no protected wild animals around the site.

c. Aquatic biota

- Coral reef

  Marked coral colony is not found around the site.

- Fish

  Kerapu, common fish in this district, is found plenty around the site. No special kind of fish is reported in this area.

- Plankton and Benthos

  The result of aquatic biology analysis is shown in **Appendix 4.6.17**. There is no national standard for plankton and benthos in seawater in Indonesia, however rather big number of phytoplankton (23,950~32,491) is measured.

- Cultural, Social and Economic Component

a. Demography and workforce

According to Arjasa District in Numbers 2000, there are 77,113 inhabitants in Ariasa District, average density was 167 persons / km2. There was 58.2% productive age inhabitant.

The site is located about 2km from residential area.

There is no possibility of resettlement.

b. Occupation

Inhabitants in this area mostly work as farmers in the rice and corn field and as fishermen with low incomes.

c. Culture of Society

Native people are Madura tribe. Majority of people are Moslems, therefore local culture and customs are much influenced by Islamic cultures.

There is a special leadership system in this district.

Paternalistic leadership system is commonly found in homogenous society in most village. It means that someone respected and honored is established either as formal leader (Village Head) or as Chief of Village Representative Body, and simultaneously as non-formal leader who handle social problems in the society. Usually, anything ordered by Village Head and Chief of Village Representative Body will be obeyed by the people.

No historical heritage or sacred places are found in Memburit island..

d. Health of the society

There is no health facilities in Membrit Island. Health facilities in Arjasa District consist of 1 public health center and 5 supplementary public health centers.

e. People's perception

Results of questionnaires for local people indicate that most of them recognize the lighthouse in detail, because many people are fishermen. They do not mind if a new lighthouse is constructed in this area.

They understand that some trees such as coconut trees will be cut down due to project, and most people do not mind if they are given fair compensation. They also expect that they could be recruited to work in the project according to their qualifications.

(4) P. Menjangan

Village	Sumber Keelampok,
District	Gerokgak,
Regency	Buleleng,
Province	Bali

① Land

a. Geography

The site is in small island named 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.

② Climate

Climatic data released in 1998-2000 by Meteorological and Geographic

Agency, Region III, Dempasar at Sumber Klompok Station, Sumenp Regency, states that the highest rainfall occurs in March and May (180.75mm), the lowest rainfall occurs in August and September (0mm). Average rainy day is 9.3 days / month. Maximum rainy days occur in January (19days). Minimum rainy days happen in August and September (0day). Average temperature is 29degrees Celsius, average wind velocity is 1.8 m/sec.

Other general climatic conditions of this district are shown in the Chapter 2 of volume 1.

③ Chemical and Physical component

a. Air quality and noise

Results of air quality analysis (3 hours method, same as national standard) with national quality standard and noise level measurement around the site, based on the result of field survey, are shown in **Appendix 4.6.18.** and **Appendix 4.6.19**.

As shown in appendix, for example, measured values of SO_2 (0.68μg/m3) and NOx (4.12μg/m3) are much lower than national quality standard (365 and 150 each).

b. Soil quality

Soil characteristic in Menjangan Island is unfertile.

Results of laboratory analysis regarding soil fertility around the site are shown in **Appendix 4.6.20**.

As shown in appendix, soil quality is strong acidity (pH 5.1~6.1 ,H_2O).

c. Quality of ground water

There is no ground water in this island.

d. Seawater quality

The result of seawater quality analysis is shown in **Appendix 4.6.21.**

As shown in appendix, for example, measured values of BOD (4.1mg/l) and SS (2mg/l) are much lower than national quality standard (45 and 80 each).

④ Biological component

a. Flora

Types of flora in this site are Waru, Alang-alang and Ddap.

There is no protected flora around the site.

b. Fauna

In Menjangan Island, there are protected wild animals, which are Deer, Python Snable, Ular, Pipit, Kutilang and Pupuh.

c. Aquatic biota

- Coral reef

  The surrounding of Menjangan Island is mostly coral reef.

- Fish

  Many kinds of tropical fishes are found in this area.

They are protected for tourism.

- Plankton and Benthos

  The result of aquatic biology analysis is shown in **Appendix 4.6.22**. There is no national standard for plankton and benthos in seawater in Indonesia, however for example, rather big number of phytoplankton (35,535~35,568) is measured..

⑤ Cultural, Social and Economic Component

a. Demography and workforce

According to Gerogkak District in Numbers 1999, there were 2,337 inhabitants in Sumber Kelompok Village, average density was 850 persons / km² There was 58.2% productive age inhabitant.

As mentioned above, there is no inhabitant in Menjangan island and no need to carry out the resettlment of people.

b. Occupation

Inhabitants in Sumber Kelompok Village mostly work as farmers in the rice and cornfield and work as industrial laborers with low incomes.

c. Culture of Society

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.

No historical heritage or sacred places are found in Menjangan island.

d. People's perception

Results of questionnaires for local people indicate that most of them recognize the lighthouse in detail, because there are many fishermen in Sumber Kelompok Village. They do not mind if a new lighthouse is constructed in this area.

(5) Merak

Village	Tamman Sari
District	Pulo Merak
Regency	Selang
Province	Banten

① Land

a. Geography

The site is in Taman Sali Village, it 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. Land usage by type of usage at Taman Sali Village is shown in **Appendix 4.6.23**.

② Climate

According to climatic data released in 1998-2000 by Meteorological and Geographic Agency, Sumenp Regency, the highest rainfall occurs in January and December (192.3mm), the lowest rainfall occurs in June, July, August and September (0mm). Average rainy day is 10 days/month. Maximum rainy days occur in January (27days). Minimum rainy days happen in August (1day). Average temperature is 31degrees Celsius, average wind speed is 2.0 m/sec.

Other general climatic conditions of this district are shown in chapter 2 of main report volume1.

③ Chemical and Physical component

a. Air quality and noise

Results of air quality analysis (3 hours method, same as national standard) and noise level measurement around the site, based on the result of field survey, are shown in **Appendix 4.6.24**. and **Appendix 4.6.25**.

As shown in appendix, for example, measured values of CO (228μg/m3) and NOx (5.12μg/m3) are very low than national quality standard (10,000 and 150 each).

b. Soil quality

Soil fertility in Taman Sali Village is classified as medium fertility.

Results of laboratory analysis regarding soil fertility around the site are shown in **Appendix 4.6.26**.

As shown in appendix, soil quality is strong acidity (pH 5.1~6.0 ,H_2O).

c. Quality of ground water

There is no well water in this area.

d. Seawater quality

The result of seawater quality analysis is shown in **Appendix 4.6.27.**

As shown in appendix, for example, measured values of BOD (15.1mg/l) and SS (3mg/l) are much lower than national quality standard (45 and 80 each).

④ Biological component

a. Flora

This area is mostly hilly dry field used as agricultural and industrial area. The site is in rice field. There is no natural vegetation around the site.

b. Fauna

The site is in the rice field. There are no protected wild animals.

c. Aquatic biota

- Coral reef

  Marked coral colony is not found around the site.

- Fish

There were common fish around the site. No special kind of fish is reported in this area.

- Plankton and Benthos

The result of aquatic biology analysis is shown in **Appendix 4.6.28**. There is no national standard for plankton and benthos in seawater in Indonesia, however, measured number of phytoplankton (30,565~30,586) is rather big.

⑤ Cultural, Social and Economic Component

a. Demography and workforce

According to Pulo Merak District in Numbers 2001, there were 2,260 inhabitants in Tamman Sari Village. Average density was 82.2 persons / km^2. There was 49.8% productive age inhabitant.

Distance to the closest residential area is about 0.5km. There is no problem of resettlement.

b. Occupation

Most inhabitants in this area work as farmers and industrial laborers with low incomes. The important agricultural crops are rice and corn.

c. Culture of Society

Native people are Bantenesse tribe. The majority of people are Moslems, therefore local culture and customs are much influenced by Islamic cultures.

There is a special leadership system in this district.

Paternalistic leadership system is commonly found in homogenous society in most village. It means that someone respected and honored is established either as formal leader (Village Head) or as Chief of Village Representative Body, and simultaneously as non-formal leader who handle social problems in the society. Usually, anything ordered by Village Head and Chief of Village Representative Body will be obeyed by the people.

No historical heritage or sacred places are found in Pulo Merak district.

d. Health of the society

There is only 1 supplementary public health center in Tamman Sari Village.

e. People's perception

Results of questionnaires for local people indicate that most of them recognize the radar site, because the area is close to sea and sea traffic of Sunda Strait. They do not mind if a new radar site is constructed in this area.

They understand that some trees such as coconut trees will be cut down due to the project, and most people do not mind if they are given fair compensation. They also expect that they could be recruited to work in the project according to their qualifications.

(6) Tanglad

Village	Tanglad
District	Nusa penida
Regency	Klungkung
Province	Bali

① Land

a. Geography

The site is in Tujuk Pusuh Hill, Tanglad Village, about 420m above sea level. The contour of Nusa Penida Island is mostly steep.

b. Land usage

The site in Tujuk Pusuh Hill is in the middle of dry field, owned by local people. There is no residence.

Land usage by type of usage at Tanglad Village and Nusa Penida District is shown in **Appendix 4.6.29**.

② Climate

According to climatic data released in 1998-2000 by Meteorological and Geographic Agency, Samparan Station, the highest rainfall occurs in February and November (307mm), the lowest rainfall occurs in May, August and September (0mm). Average rainy day is 7.8 days/month. Maximum rainy days occur in November (25days). Minimum rainy days happen in May, August and September (1day). Average temperature is 31degrees Celsius, and average wind velocity is 1.5m/sec.

Other general climatic conditions of this district are shown in the Chapter 2 of main report volume1.

③ Chemical and Physical component

a. Air quality and noise

Results of air quality analysis (3 hours method, same as national standard) and noise level measurement around the site, based on the result of field survey, are shown in **Appendix 4.6.30**. and **Appendix 4.6.31**.

As shown in appendix, for example, measured value of NOx (2.05μg/m3) are much lower than national quality standard (150).

b. Soil quality

Soil characteristics in Tanglad Village is marked by shallow soil (50cm) and low fertility.

Results of laboratory analysis regarding soil fertility around the site are shown in **Appendix 4.6.32**.

As shown in appendix, soil quality is weak acidity (pH 5.1~6.8,H_2O).

c. Quality of ground water

There is no well water in Tanglad Village.

d. Seawater quality

The Tanglad Village is about 420m above sea level, and site is in the middle of village, therefore, laboratory analysis of seawater quality, plankton and benthos were not conducted.

④ Biological component

a. Flora

This area is mostly hilly dry field, as mentioned above, site is in the middle of village. There is no protected flora.

b. Fauna

The site is in the village. There are no protected wild animals in this village.

⑤ Cultural, Social and Economic Component

a. Demography and workforce

According to Nusa Penida District in Numbers 1999, there were 2,288 inhabitants in Tanglad Village. Average density was 150 persons / km^2. There was 58.2% productive age inhabitant in Nusa Pnida District.

The site is in a hill, there is no inhabitant, distance to the nearest residential area is about 2km.

There is no possibility of resettlement.

b. Occupation

Most inhabitants in this district work as farmers with low incomes. The important agricultural crops are Jumbu Mete, and Kemeri.

c. Culture of Society

Native people are Bali tribe. The majority of people are Hindu, therefore local culture and customs are much influenced by Hindu cultures.

There is a special leadership system in this district.

Paternalistic leadership system is commonly found in homogenous society in most villages. It means that someone respected and honored is established either as formal leader (Village Head) or as Chief of Village Representative Body.

Body, and simultaneously as non-formal leader who handle social problems in the society. Usually, anything ordered by Village Head and Chief of Village Representative Body will be obeyed by the people.

No historical heritage or sacred places are found around the site.

d. Health of the society

There is only 1 supplementary public health center in Tanglad Village.

e. People's perception

Results of questionnaires for local people indicate that most of them recognize the radar site, because the area is close to sea and sea traffic of

Lombok Strait. They do not mind if a new radar site is constructed in this area.

They understand that some trees such as coconut trees will be cut down due to project, and most people do not mind if they are given fair compensation. They also expect that they could be recruited to work in the project according to their qualifications.

4.6.4. Environmental Impacts Arising from the Planned Project

Based on the results of survey of present environmental conditions, the impacts arising from the planned project at the 6 sites were studied. Results of the study are as follows:

(1) P. Timau

① Chemical and Physical Component

a. Air quality

Environmental impacts are the increase of SO2, NOx, CO and dust, discharged from the construction machinery and lighthouse operation, however, taking the volume of waste gas and the average wind velocity of 2.5 m/sec. in this district into account, waste gas emission will be completely dispersed to the air, and then this impact will be classified as not significant one.

It needs neither management nor monitoring.

b. Noise

Construction activities will cause noise increase. Generally, maximum noise intensity of lighthouse construction work is about 100dB(A). Noise dispersion will decrease the noise level to about 58 dB(A) at the distance of 100m from the source.

Timau island is not inhabited, and there is no protected animal, thus the noise dispersion will not cause any inconvenience..

The noise impact does not need management and monitoring.

c. Sea water quality

Possible impacts are liquid and solid waste come from construction work and residence of lighthouse operators, however, waste water and solid waste will be dumped in dumping area, therefore, the environmental impact can be classified as not significant.

It does not need management and monitoring.

② Biological component

a. Flora

Possible impact is the loss of vegetation according to land leveling work. This impact can be classified as not significant because the flora in this island is not protected, therefore, this impact does not need management and monitoring.

b. Fauna

There seems to be no significant impact, because the dry field expands extensively and impedes the wildlife to inhabit. Therefore, this impact does not need management and monitoring.

③ Cultural, Social and Economic component

a. Land usage and plantation compensation

As mentioned above, Timau island is owned by local government, and there is no inhabitant. Possible impact can be classified as small. However, to avoid negative opinion from the local government, management and monitoring for this impact should be done.

b. Employment opportunities

There is no inhabitant in Timau island, however, employment of workforce for Bungran island can be classified as direct positive impact. Though the type of impact is not significant, proper management and monitoring should be conducted, because only few people could be employed, and a request from local people for more employment might arise.

(2) Tg. Sading

① Chemical and Physical Component

a. Air quality

Environmental impacts are the increase of SO_2, NO_x, CO and dust, discharged from the construction machinery and lighthouse operation, however, taking the volume of waste gas and the average wind velocity of 2.6 m/sec. in this district into account, waste gas emission will be completely dispersed to the air, and then this impact will be classified as not significant one.

It needs neither management nor monitoring.

b. Noise

Construction activities will cause noise increase. Generally, maximum noise intensity of lighthouse construction work is about 100dB(A). Noise dispersion will decrease the noise level to about 58 dB(A) at the distance of 100m from the source.

The noise will not cause any inconvenience to the people.

The noise impact does not need management and monitoring.

c. Sea water quality

Possible impacts are liquid and solid waste come from construction work and residence of lighthouse operator, however, waste water and solid waste will be dumped in dumping area, also, the site is located about 0.5 km from coast, therefore, the environmental impact can be classified as not significant.

It does not need management and monitoring.

② Biological component

a. Flora

Possible impact is the loss of bush according to land leveling work. This impact can be classified as small and unimportant, therefore, this impact does not need management and monitoring.

b. Fauna

There is not any type of impact, due to no protected wild animals. Therefore, it does not need management and monitoring.

③ Cultural, Social and Economic component

a. Land usage compensation

The site is owned by Bintan International Resort Co..

Type of impact is not significant, since Bintan International Resort Co.will accept the construction of lighthouse. However, to avoid negative opinion from Bintan International Resort Co, management and monitoring for this impact should be done.

b. Employment opportunities

Employment of workforce can be classified as direct positive impact. Though the type of impact is not significant, proper management and monitoring should be conducted, because only few people could be employed, and a request from local people for more employment might arise.

(3) Memburit

① Chemical and Physical Component

a. Air quality

Environmental impacts are the increase of SO2, NOx, CO and dust, discharged from the construction machineries and lighthouse operation, however, taking the volume of waste gas and the average wind velocity of 2.0 m/sec. in this district into account, waste gas emission will be completely dispersed to the air, and then this impact will be classified as not significant one.

It needs neither management nor monitoring.

b. Noise

Construction activities will cause noise increase. Generally, maximum noise intensity of lighthouse construction work is about 100dB(A). Noise dispersion will decrease the noise level to about 58 dB(A) at the distance of 100m from the source.

The distance from the closest residential area to the site is about 0.5 km, thus the noise will not cause any inconvenience to the people.

The noise impact does not need management and monitoring.

c. Sea water quality

Possible impacts are liquid and solid waste come from construction work and residence of lighthouse operator, however, waste water and solid waste will be dumped in dumping area, therefore, the environmental impact can be classified as not significant.

It does not need management and monitoring.

② Biological component

a. Flora

Possible impact is the loss of farmland according to land leveling work. This impact can be classified as not significant, therefore, this impact does not need management and monitoring.

b. Fauna

There seems to be no significant impact, because the dry field expands extensively and impedes the wildlife to inhabit.

Therefore, it does not need management and monitoring.

③ Cultural, Social and Economic component

a. Land usage and plantation compensation

Dry fields in Membrit Island Village are owned by local people.

Type of impact is not significant, since the people will receive land and farmland compensation. However, to avoid negative opinion from the local people, management and monitoring for this impact should be done.

b. Employment opportunities

Employment of workforce can be classified as direct positive impact. Though the type of impact is not significant, proper management and monitoring should be conducted, because only few people could be employed, a request from local people for more employment might arise.

(4) P. Menjangan

① Chemical and Physical Component

a. Air quality

This island is natural conservation area that belongs to the local government.

Impacts are the increase of SO2, NOx, CO and dust, discharged from the construction equipments, however, taking the volume of waste gas and average wind velocity of.1.8 m/sec. in this district into account, waste gas emission will be completely dispersed to the air, therefore, this impact will be not significant.

It needs neither management nor monitoring.

b. Noise

Construction activities will cause noise increase. Noise dispersion will decrease the noise level to about 58 dB(A) at the distance of 100m from the source.

Protected faunas in this area are Deer, Python Snake and Coral Reef Fish. Noise dispersion will cause some inconvenience to them.

However, the impact of noise occur in a radius of about 100m from the site, therefore, this impact of noise can be classified as not significant one. The noise impact does not need special management and monitoring.

c. Sea water quality

Possible impact is the overflow of solid waste come from construction work and residence of lighthouse operator, due to heavy rainfall.

This impact must be managed and monitored to avoid any overflow to the sea. If it is managed suitably the impact can be classified as not significant.,

② Biological component

a. Flora

Possible impact is the loss of vegetation according to the leveling of land for construction of lighthouse.

However, the area of leveling is 0.5 Ha, impact can be classified as not significant, therefore, this impact does not need management and monitoring.

b. Fauna

Though it is limited time of construction work, the construction work will cause animals to migrate away from the site. This is significant impact, because the site is in the natural conservation area and there are protected animals as mentioned above. This impact can be classified as significant. The impact needs management and monitoring.

③ Cultural, Social and Economic component

a. Land usage and farm land compensation

Type of impact is not significant, since the area belongs to local government. However, to avoid negative opinion from the local government, management monitoring for this impact should be done.

b. Employment opportunities

Employment of local people can be classified as not significant impact, however, only few local people could be employed, a request from local people for more employment might be arise.

Proper management and monitoring of this impact should be done.

(5) Merak

① Chemical and Physical Component

a. Air quality

Impacts are the increase of SO_2, NO_x, CO and dust discharged from the construction equipments, however, taking the volume of waste gas and wind condition of this district (2.0 m/sec) into account, waste gas emission will be completely dispersed to the air.

This impact will be categorized as not significant.

It needs neither management nor monitoring.

b. Noise

The highest level of noise occurs during construction phase. Generally, maximum noise intensity of radar site construction work is about 100dB(A). Noise dispersion will decrease the noise level to about 58 dB(A) at the distance of 100m from the source.

The closest residential area from the site is 0.5 km. Thus the noise dispersion will not cause any inconvenience to the people.

The noise impact does not need special management and monitoring.

c. Sea water quality

The radar tower construction project will not affect the quality of surrounding seawater, because the location is 134m above sea level, and about 1 km from the coast.

② Biological component

a. Flora

Possible impact is the loss of dry field for vegetation according to the construction work of radar station.

This impact can be classified as not significant, therefore, this impact does not need management and monitoring.

b. Fauna

There seems to be no significant impact, because the dry field expands extensively and impedes the wildlife to inhabit. This impact is no need to be managed or monitored.

③ Cultural, Social and Economic component

a. Land usage and plantation compensation

The site is located in dry field areas owned by local people. Type of impact is not significant, since the people will receive land and plantation compensation.

However, to avoid negative opinion from the local people, proper management and monitoring of this impact should be done.

b. Employment opportunities

Employment of local people can be classified as not significant impact, however, only few local people could be employed, a request from local people for more employment might be arise.

Proper management and monitoring of this impact should be done.

(6) Tanglad

① Chemical and Physical Component

a. Air quality

Impacts are increase of SO_2, NO_x, CO and dust, discharged from the construction equipments, however, taking the volume of waste gas and average wind velocity of this district (1.5m/sec.) into account, waste gas emission will be completely dispersed to the air. This impact will be categorized as not significant.

It needs neither management nor monitoring.

b. Noise

The highest level of noise occurs during construction phase, and reaches 100m from the source, however, noise dispersion will decrease the noise level to about 58 dB(A) at the distance of 100m from the source.

Distance from the closest residential area to the site is about 2 km. Thus the noise dispersion will not cause any inconvenience to the people.

The noise impact does not need any management and monitoring.

c. Sea water quality

The site is in the Tanglad Village, 420m above sea level, about 1 km from the coast, radar construction project will not affect the quality of surrounding seawater.

d. Airline traffic

Possible impact is frequency interference with airline traffic radar, however, each radar for maritime traffic and airline traffic has fixed different frequency, and also, the site is located about 54 km from Ngurah Rai Airport, therefore, the type of impact is not significant, and it does not need management and monitoring.

② Biological component

a. Flora

Impact toward vegetation is direct. Possible impact is the loss of corn plantation according to the construction of radar station.

However, this impact can be classified as not significant, therefore, this impact does not need management and monitoring.

b. Fauna

There seems to be no significant impact, because the dry field expands extensively and impedes the wildlife to inhabit. This impact does not need to be managed or monitored.

③ Cultural, Social and Economic component

a. Land usage and plantation compensation

The site is located in dry field areas owned by local people. Type of impact is not significant, since the people will receive land and plantation compensation.

Possible impact can be classified as not significant.

b. Employment opportunities

Employment of local people can be classified as not significant impact, however, only few local people could be employed, and request from local people for more employment might be arise.

This impact should be managed and monitored.

4.6.5. Environmental Management Effort (UKL)

Based on the results of study on the impacts arising from planned project, the UKL Plan was drawn up as follows:

(1) P. Timau

① Management of land release compensation

a. To socialize project activities to the local government, formal leader and non-formal leader in the West Bungran District..

b. To measure and map the land for the project.

② Management of employment opportunity

a. To provide wide information on the project to the local people.

b. To provide employment opportunities to the local people according to requirements and needs of project.

(2) Tg. Sading

① Management of land release compensation

a. To socialize project activities to Bintan International Resort Co. The socialization should involve non-formal leaders in the area.

b. To measure and map the land for the project.

c. To negotiate with Bintan International Resort Co. on the amount of compensation.

d. To hand over the compensation as soon as agreement can be reached, and it must be witnessed by local government.

② Management of employment opportunity

a. To provide wide information on the project to the local people.

b. To provide employment opportunities to the local people according to requirements and needs of project.

(3) Memburit

① Management of land release compensation

a. To socialize project activities to the people, especially those living around the site. The socialization should involve Village Head, Village Representative Agency and non-formal leaders in the area.

b. To measure and map the land for the project.

c. To negotiate with local people on the amount of compensation. The negotiation meeting must be attended by Village Head, Village Representative Agency and non-formal leaders in the area.

d. To hand over the compensation as soon as agreement can be reached, and it must be witnessed by Village Head, Village Representative Agency, non-formal leaders and officials of local government in the area

② Management of employment opportunity

a. To provide wide information on the project to the local people.

b. To provide employment opportunities to the local people according to requirements and needs of project.

(4) P. Menjangan

① Management of land release compensation

a. To socialize project activities to the local government, formal leader and non-formal leader in the District..

b. To measure and map the land for the project.

② Management on seawater quality

Solid waste of ex-construction and from domestic waste is to be collected. Then the waste is transported and disposed of at final waste dumping site.

③ Flora

Construction works for lighthouse should be limited to daytime.

④ Cultural, Social and Economic component

a. To provide wide information to the local people about lighthouse development project.

b. To provide employment opportunities for local people according to requirement and needs of project.

(5) Merak

① Management of land release compensation

a. To socialize project to local people, especially those living around the site. The socialization should involve Village Head, Village Representative Agency and non-formal leaders in the area.

b. To measure and map the land for the project

c. To negotiate with local people on the amount of compensation. Negotiation meeting must be attended by Village Head, Village Representative Agency and non-formal leaders in the area.

d. To hand over the compensation as soon as agreement reached, and must be witnessed by Village Head, Village Representative Agency, non-formal leaders and officials of local government in the area

② Management of employment opportunity

a. To provide wide information on the project to the local people.

b. To provide employment opportunities for local people, according to requirements and needs of project.

(6) Tanglad

① Management of land release compensation

a. To socialize project to local people, especially those living around the site. The socialization should involve Village Head, Village Representative Agency and non-formal leaders in the area.

b. To measure and map the land for the project

c. To negotiate with local people on the amount of compensation. The negotiation meeting must be attended by Village Head, Village Representative Agency and non-formal leaders in the area.

d. To hand over the compensation as soon as agreement reached, and must be witnessed by Village Head, Village Representative Agency, non-formal leaders and officials of local government in the area

② Management of employment opportunity

a. To provide wide information on the project to the local people.

b. To provide employment opportunities for local people, according to requirements and needs of project.

4.6.6. Environmental Monitoring Effort (UPL)

Based on the results of study on the impacts arising from the planned project, the Environmental Monitoring Effort Plan was drawn up as follows:

(1) P. Timau

① Monitoring on land release compensation

To prevent any negative perception from the local government of West Bunguran District, some monitoring effort should be conducted. Parameter to be monitored is agreement of land release.

② Monitoring on employment opportunity

Type of impact to be monitored is employment opportunity to work in the project. Parameter to be monitored is the number of local workers who could fill the vacancies according to qualifications and the project needs.

(2) Tg. Sading

① Monitoring on land release compensation

To prevent negative perception from the Bintan International Resort Co., some environmental monitoring effort should be conducted. Parameter to be monitored is agreement on the compensation value of land release and Bintan International Resort Co. management on the compensation.

② Monitoring on employment opportunity

Type of impact to be monitored is employment opportunity to work in the project. Parameter to be monitored is the number of local workers who could fill the vacancies according to qualifications and the project needs.

(3) Memburit

① Monitoring on land release compensation

To prevent negative perception from the people, environmental monitoring effort should be conducted. Parameter to be monitored is agreement on the compensation and people's perception on the compensation.

② Monitoring on employment opportunity

Type of impact to be monitored is employment opportunity to work in the project. Parameter to be monitored is the number of local workers who could fill the vacancies according to qualifications and the project needs.

(4) P. Menjangan

① Monitoring on land release compensation

To prevent any negative perception from the local government, some monitoring effort should be conducted. Parameter to be monitored is agreement of land release.

② Monitoring on seawater quality

Seawater quality monitoring shall be carried out during the construction phase. Parameters monitored are BOD,COD, pH and oil.

③ Monitoring on fauna

The conditions of protected fauna should be monitored carefully.

④ (4) Monitoring on employment opportunities

Type of impact to be monitored is employment opportunity to work in the project. Parameter to be monitored is the number of local workers who could fill the vacancies according to qualifications and the project needs.

(5) Merak

① Monitoring on land release compensation

To prevent any negative perception from the people, environmental monitoring effort should be conducted. Parameter to be monitored is agreement on the compensation value of dry field release, and the people's perception on the compensation.

② Monitoring on employment opportunity

Type of impact to be monitored is employment opportunity to work in the project. Parameter to be monitored is the number of local workers who could fill the vacancies according to qualifications and the project needs.

(6) Tanglad

① Monitoring on land release compensation

To prevent any negative perception from the people, environmental monitoring effort should be conducted. Parameter to be monitored is mutual agreement on the compensation value of rice field release, and people's perception on the compensation.

② Monitoring on employment opportunity

Type of impact to be monitored is employment opportunity to work in the project. Parameter to be monitored is the number of local workers who could fill the vacancies according to qualifications and the project needs.

4.6.7. 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 4.6.1.**

Table 4.6.1. Summary of Environmental Impacts

a. 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

b. 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 4.6.2.**

Table 4.6.2. 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

4.6.8. 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 5.

RECOMMENDABLE PRIORITY PROJECTS

CHAPTER 5.
RECOMMENDABLE PRIORITY PROJECTS

5.1. Economic Analysis of Proposed Priority Projects

5.1.1. Purpose

To make effective use of limited resource (human resources, commodities, currency), the cost benefit analysis should be implemented quantitatively as far as possible on the viewpoint of effective utilization of resources. The items, which cannot be converted into currency, should be expressed by qualitatively.

5.1.2. Specification of Projects

The specifications for the priority projects are visual aids to navigation including supporting facilities, DGPS, VTS system, GMDSS and ship reporting system.

(1) Visual Aids to Navigation including supporting facilities

① Rehabilitation and improvement of visual aids to navigation.

Rehabilitation and improvement of visual aids to navigation are shown in **Table 5.1.1.**

Table 5.1.1. Rehabilitation and Improvement of Visual Aids to Navigation

Light Houses	21 Locations
Light Beacons	131 Locations
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 shown in **Table 5.1.2.**

Table 5.1.2. Development of Visual Aids to Navig ation and Supporting Facilities

Light Houses	8 Locations
Light Beacons	33 Locations
Light Buoys	34 units

(2) DGPS

3 DGPS Stations should be established.

(3) VTS System

VTS System in 2 areas (Sunda Straits, Lombok Straits) should be 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 stations, 2nd class 9 stations, 3rd class 31 stations) should be installed with related equipments.

5.1.3. 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, and therefore evaluation periods of the projects are settled on termination year for use as shown in **Table 5.1.3.**

Table 5.1.3. Termination for Use

Type	Main body	Years
Light House	GRP	15
	Iron	30
	Aluminum	50
	Concrete	70
	Casting	100
Light Buoy		10
DGPS		15
VTS System		15
GMDSS		15
Ship Reporting System		15

Source: The Study Team

5.1.4. Approach and Methodology of the 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 estimation of decrease effects of vessel's collisions by the projects, without case means zero effects without the projects.

(1) Aids to Navigation

In Indonesian waters, the benefit is the decrease effects of vessel's collisions as a result of the organization of traffic flows.

By the organization of traffic flows, the collisions at sea should be decreased. Forecasting the collision at Indonesian waters, **Formula 5.1.1**,**Formula 5.1.2** should be applied.

$$Ng=\sum_{i}\sum_{j} DiDj\, W_{ij} \,|\, \vec{Vi}-\vec{Vj} \,|\, T \qquad \textbf{(Formula 5.1.1)}$$

$$N / Ng=P \qquad \textbf{(Formula 5.1.2)}$$

Where

Ng: Number of theoretical collisions

Di : Traffic density for direction i

Dj : Traffic density for direction j

Wij : Average ship's length

$|\,\vec{Vi}-\vec{Vj}\,|$: Relative speed of two group of vessels

T : Hours

N :Number of actual collisions

The decreased number of collisions are shown **in Appendix5.1.1.**

Damage and loss per vessel, which mean benefit per one vessel, is shown in **Appendix 5.1.2.**

Total Benefit is shown in **Table 5.1.4**. In this table, social discount rate is used 10%, which is used at international bank such as World Bank. Economic internal rate of return (EIRR) show 12.0 %. In this case, EIRR is bigger than social discount rate, therefore this project has enough benefit. .

Table 5.1.4. Economic Analysis for Visual Aids to Navigation and Supporting Facilities

Year		Social Discount Rate	Benefit		Remaining Price	Present Value	Civil		Operating & Maintenance Cost		Present Value of Costs
			Benefit	Present Value			Cost	Present Value	Cost	Present Value	
		10%									
2003	1	1.000									
2004	2	0.900					0.597	0.537			0.537
2005	3	0.810					9.230	7.476			7.476
2006	4	0.729					7.584	5.529			5.529
2007	5	0.656	3.887	2.550		2.550	7.456	4.892			4.892
2008	6	0.590	6.908	4.079		4.079			0.030	0.017	0.017
2009	7	0.531	7.922	4.210		4.210			0.082	0.043	0.043
2010	8	0.478	8.936	4.274		4.274			0.042	0.020	0.020
2011	9	0.430	10.013	4.310		4.310			0.290	0.125	0.125
2012	10	0.387	11.027	4.272		4.272			1.081	0.419	0.419
2013	11	0.349	12.041	4.198		4.198			0.082	0.029	0.029
2014	12	0.314	13.118	4.117		4.117			0.069	0.022	0.022
2015	13	0.282	14.132	3.991		3.991			0.680	0.192	0.192
2016	14	0.254	15.210	3.866		3.866			0.042	0.011	0.011
2017	15	0.229	16.224	3.711		3.711			4.149	0.949	0.949
2018	16	0.206	17.238	3.549		3.549			0.042	0.009	0.009
2019	17	0.185	18.315	3.394		3.394			0.288	0.053	0.053
2020	18	0.167	19.329	3.224		3.224			0.042	0.007	0.007
2021	19	0.150	20.343	3.053		3.053			0.325	0.049	0.049
2022	20	0.135	21.420	2.894		2.894			1.097	0.148	0.148
2023	21	0.122	22.434	2.727		2.727			0.304	0.037	0.037
2024	22	0.109	23.468	2.568		2.568			0.042	0.005	0.005
2025	23	0.098	24.504	2.413		2.413			0.290	0.029	0.029
2026	24	0.089	25.539	2.264		2.264			0.042	0.004	0.004
2027	25	0.080	26.575	2.120		2.120			7.992	0.638	0.638
2028	26	0.072	27.611	1.982		1.982			0.025	0.002	0.002
2029	27	0.065	28.647	1.851		1.851			0.290	0.019	0.019
2030	28	0.058	29.683	1.726		1.726			0.042	0.002	0.002
2031	29	0.052	30.719	1.608		1.608			0.304	0.016	0.016
2032	30	0.047	31.755	1.496		1.496			1.097	0.052	0.052
2033	31	0.042	32.791	1.390		1.390			0.289	0.012	0.012
2034	32	0.038	33.827	1.291		1.291			0.042	0.002	0.002
2035	33	0.034	34.863	1.197		1.197			0.339	0.012	0.012
2036	34	0.031	35.899	1.109	0.064	1.109			0.042	0.001	0.001
TTL			624.377	85.434	0.064	85.498	24.867	18.434	19.480	2.921	21.356
										EIRR	**12.0%**

(2) DGPS

The benefits of DGPS are the decrease of vessel's collisions and that of going 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 (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 among 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 10.5 meters. Therefore estimation of quantitative benefits for GPS is almost impossible in the range of this study.

But attention have to be paid following. Some tanker berth in Japan, it was utilized as measuring of tanker approaching speed to her berth, because tanker-approaching speed to her berth is extremely limited. Therefore in Indonesia, with increase of import of crude oil, it may be utilized same way.

(3) VTS System

In Sunda Strait, the benefit is the decrease effect of vessel's collision as a result of the advices by VTS station to rectify the traffic flow, especially collisions in meeting situation and crossing situation.

Forecasting the collision at Indonesian waters, **Formula 5.1.1,Formula 5.1.2,** should be applied. The decreased number of collisions are shown in **Appendix5.1.3.**

Damage and loss per vessel, which mean benefit per one vessel, is shown in **Appendix 5.1.2.**

Total Benefit is shown in **Table 5.1.5**. In this table, social discount rate is used 10%, which is used at international bank such as World Bank. EIRR show 17.3 %. In this case, EIRR is bigger than social discount rate, therefore this project has enough benefit.

Table 5.1.5. Economic Analysis for VTS System

Year		Social Discount Rate	Benefit: Benefit	Benefit: Present Value	Remaining Price	Present Value	Civil: Cost	Civil: Present Value	Operating & Maintenance Cost: Cost	Operating & Maintenance Cost: Present Value	Present Value of Costs
		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%**

(4) GMDSS

Purpose of GMDSS is to establish the distress and safety communication system in Indonesian waters. GMDSS put into service in February 1992 and 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 5.1.6**.

Table 5.1.6 Benefits and Costs for GMDSS

	Items	Contents	Party to be belonged
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 measure, crew's family do not influence due to incorrect news.	Crew's family
Costs	• Occurrence of installation costs	• Installation costs for the project occur.	GOI
	• Increasing rescue costs due to mishandle the 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 5.1.7**.

Table 5.1.7. "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 by Indonesian sentence, 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 "With" 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 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 a time for search the ship in distress. Search costs in distress will maintain the present condition.
Social unrest due to incorrect news	Decreasing • By reliable transmitting measure, crew's family do not influence due to incorrect news. Social unrest due to incorrect news will decrease.	No change • By unreliable transmitting measure, crew's family will influence due to incorrect news. Social unrest due to incorrect news will maintain the present conditions.

③ Evaluation of Benefits and costs

Considering **Table 5.1.6** and **Table 5.1.7**, items are very hard to convert into currency. But it has potential energy for saving human life 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 life and increasing navigational safety are fully worth the projects costs.

(5) Ship Reporting System

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.

① Benefits and costs

By development of ship reporting system, benefits and costs are analyzed in **Table 5.1.8**.

Table 5.1.8 Benefits and Costs for Ship Reporting System

	Items	Contents	Party to be belonged
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 5.1.9**.

Table 5.1.9. "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 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 a time for search 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 5.1.8**, **Table 5.1.9**, items are very hard to convert into currency. But it has fairly strong effects for 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 above effects. The effects for decreasing loss of human life and increasing navigational safety are fully worth the projects costs.

5.2. Financial Analysis

5.2.1. Purpose

The projects under review have expected light dues. On the point of GOI, capability 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.

5.2.2. 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. It was shown in **Table 5.2.1**. Primary balance improves gradually but overall balance is always deficit and domestic financing and foreign financing have covered deficit.

Table 5.2.1. The Budgeted Government Revenue and Expenditures

Unit: Billion Rupiah

	1999/2000 1)	2000 2)	2001 3)
Revenue and Grants	129,204	152,896	263,227
Domestic Revenue	129,204	152,896	263,227
Tax Revenue	99,481	101,437	179,892
Domestic Tax	93,936	95,538	169,520
International Trade Tax	5,545	5,899	10,372
Non Tax Revenue	29,723	51,459	83,335
Natural Resource Revenue	18,120	40,082	64,458
Profit Transfer from from SOE's	4,000	5,281	10,500
Other Non Tax Revenue	7,603	6,096	8,377
Grants	0	0	0
Expenditure	212,699	197,030	315,756
Central Government Expenditure	177,072	163,508	234,079
Current Expenditure	131,454	137,311	190,092
Development Expenditure	45,618	26,197	43,987
Program Aid in Rupiah	15,618	10,167	21,722
Project Aid	30,000	16,030	22,265
Balance Funds	35,627	33,522	81,677
Revenue Sharing	2,902	2,593	20,259
Central Allocation Funds	32,725	30,929	60,517
Special Allocation Funds	0	0	901
Primary Balance	-28,969	10,490	24,020
Overall Balance	-83,495	-44,134	-52,529
Financing Net	83,495	44,134	52,529
Domestic Financing	30,000	25,400	33,500
Domestic Bank Financing	0	0	33,500
Domestic Non Bank Financing	30,000	25,400	0
Foreign Financing	53,495	18,734	19,029
Gross Drawing	77,400	27,330	35,992
Amortizations	-23,905	-8,596	-16,963

Note: 1) April 1999 – March 2000
2) April 2000 - December 2000
3) January 2001 – December 2001

Source: Ministry of Finance

5.2.3. Total Amount of Investment

Total amount of investment is estimated in **Table 5.2.2.**

Table 5.2.2. Total Amount of Investment

Units: Thousand US$

Items	Foreign Cost	Local Cost	Total
Visual Aids to Navigation and 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	87,821

5.2.4. Raising Funds for Investment

Soft loans from foreign banks should be considered for raising funds for investment. Examples of terms and conditions for repayment of soft loans from foreign banks are shown in **Table 5.2.3.**

Table 5.2.3. Soft Loans from Foreign Banks

	Interest	Loan Period	Grace Period	Notes
A Bank	0.75 %	40 Years	10 Years	0.75% interest to be applied to 56 % of total amount of loan
	6.47 %	10 Years	During construction	6.47% interest to be applied to 44 % of total amount of loan
B Bank	3.47 %	18 Years	7 Years	
C Bank	3.5 %	17 Years	3 Years	
D Bank	5.88 %	10 years	—	0.6 % should be added to interest.
ODA Loan	1.8 %	30 Years	10 Years	Loan is limited 85 % of total amount of investment.

In the meantime, terms and conditions of repayment for market rate are that interest rate is 6 % and loan period is 10 years.

The hypothetical terms and conditions the study team has implemented are to use official development plan (ODA) and market rate. ODA can be broadly divided into bilateral ODA and multilateral ODA. Bilateral ODA consist of bilateral grants and ODA loan. 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 and market rate are as follows;

(1) ODA Loan

① 15% of total amount of investments (foreign cost + local cost) should be paid from funds of GOI as a down payment.

② 85% of total amount of investments (foreign cost + local cost) 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%.

(2) Market Rate

① 15% of total amount of investments (foreign cost + local cost) should be paid from funds of GOI as a down payment.

② 85% of total amount of investments (foreign cost + local cost) should be loaned to GOI.

③ Loan period is 10 years and interest rate is 6 %.

5.2.5. Calculation for Revenue

Light dues shall be applied to civil works, facilities, machineries, consulting services and other project needs including operating costs, maintenance costs.

According to Communication Bureau of BAPPENAS, 50 % of light dues would be used for Aids to Navigation, supporting facilities and maritime telecommunication. Total amount of light dues are shown in **Table 5.2.4**.

Table 5.2.4. Forecast of Total Amount of Light Dues

Unit: US$

	Likeliest Case	Optimistic case	Pessimistic case
2001	13,094,871	13,094,871	13,094,871
2002	13,994,919	14,299,280	13,693,165
2003	15,175,099	15,840,522	14,529,724
2004	16,457,496	17,552,026	15,418,950
2005	17,851,062	19,452,916	16,364,140
2006	19,365,604	21,564,506	17,368,926
2007	21,011,787	23,910,529	18,437,133
2008	22,801,228	26,517,322	19,572,836
2009	24,746,609	29,414,371	20,780,317
2010	26,861,736	32,634,381	22,064,230
2011	28,511,141	35,219,045	23,028,102
2012	30,262,043	38,008,812	24,034,193
2013	32,120,739	41,019,967	25,084,356
2014	34,093,864	44,270,169	26,180,527
2015	36,188,427	47,778,381	27,324,760
2016	38,411,972	51,565,123	28,519,104
2017	40,772,431	55,652,583	29,765,799
2018	43,278,280	60,064,632	31,067,147
2019	45,938,441	64,827,119	32,425,552
2020	48,762,475	69,967,924	33,843,512

5.2.6. Consideration for Financial Internal Rate of Return (FIRR)

To examine the feasibility of each project, consideration for FIRR should be implemented. The initial costs, operating costs and maintenance costs of visual aids to navigation and supporting facilities, DGPS, VTS system, GMDSS and ship reporting system are shown in **Table 5.2.5.**

Table 5.2.5. Total Costs (Initial Costs, Operating Costs and Maintenance Costs)

Units: Million US$

	No	Year	Visual Aids to Navigation and Supporting Facilities				DGPS				VTS System				GMDSS				Ship Reporting System				Total				
			Civil	Consultant	Total Initial Cost	Operating & Maintenance Cost	Civil	Consultant	Total Initial Cost	Operating & Maintenance Cost	Civil	Consultant	Total Initial Cost	Operating & Maintenance Cost	Civil	Consultant	Total Initial Cost	Operating & Maintenance Cost	Civil	Consultant	Total Initial Cost	Operating & Maintenance Cost	Civil	Consultant	Total Initial Cost	Operating & Maintenance Cost	Initial, Operating & Maintenance Cost
			1	2	3=1+2	4	5	6	7=5+6	8	9	10	11=9+10	12	13	14	15=13+14	16	17	18	19=17+18	20	21	22	23=21+22	24	25=23+24
	1	2000																									
	2	2001																									
	3	2002																									
	4	2003														0.689	0.689							0.689	0.689		0.689
	5	2004		0.597	0.597						0.952	0.261	1.213			0.862	0.862						0.952	1.720	2.672		2.672
	6	2005	8.832	0.398	9.230						1.622	0.195	1.817		13.784	0.862	14.646			0.297	0.297		24.238	1.752	25.990		25.990
	7	2006	6.987	0.597	7.584			0.161	0.161		2.290	0.130	2.420		15.507	0.689	16.196		1.982	0.297	2.280		26.767	1.875	28.641		28.641
1	8	2007	7.058	0.398	7.456		4.681	0.121	4.801		0.540	0.065	0.605		6.892	0.517	7.409	0.361	5.452	0.297	5.749		24.623	1.398	26.021	0.361	26.381
2	9	2008				0.030	0.565	0.121	0.686					0.075				0.361	2.974	0.149	3.122	0.139	3.539	0.269	3.808	0.604	4.412
3	10	2009				0.082				0.027				0.075				0.361				0.139				0.682	0.682
4	11	2010				0.042				0.027				0.075				0.361				0.139				0.643	0.643
5	12	2011				0.290				0.027				0.075				0.361				0.139				0.891	0.891
6	13	2012				1.081				0.027				0.075				0.361				0.139				1.681	1.681
7	14	2013				0.082				0.027				0.075				0.361				0.139				0.682	0.682
8	15	2014				0.069				0.027				0.075				0.361				0.139				0.670	0.670
9	16	2015				0.680				0.027				0.075				0.361				0.139				1.281	1.281
10	17	2016				0.042				0.027				0.075				0.361				0.139				0.643	0.643
11	18	2017				4.149				0.027				0.075				0.361				0.139				4.750	4.750
12	19	2018				0.042				0.027				0.075				0.706				0.139				0.987	0.987
13	20	2019				0.288				0.027				1.288				0.792				0.139				2.532	2.532
14	21	2020				0.042				0.027				1.892				7.684				0.287				9.931	9.931
15	22	2021				0.325				0.187				2.495				8.459				1.278				12.744	12.744
16	23	2022				1.097				4.828				0.680				4.065				3.013				13.683	13.683
17	24	2023				0.304				0.712				0.075				0.361				1.700				3.152	3.152
18	25	2024				0.042				0.027				0.075				0.361				0.139				0.643	0.643
19	26	2025				0.290				0.027				0.075				0.361				0.139				0.891	0.891
20	27	2026				0.042				0.027				0.075				0.361				0.139				0.643	0.643
21	28	2027				7.992				0.027				0.075				0.361				0.139				8.593	8.593
22	29	2028				0.025				0.027				0.075				0.361				0.139				0.626	0.626
23	30	2029				0.290				0.027				0.075				0.361				0.139				0.891	0.891
24	31	2030				0.042				0.027				0.075				0.361				0.139				0.643	0.643
25	32	2031				0.304				0.027				0.075				0.361				0.139				0.905	0.905
26	33	2032				1.097				0.027				0.075				0.361				0.139				1.697	1.697
27	34	2033				0.289				0.027				0.075				0.361				0.139				0.890	0.890
28	35	2034				0.042				0.027				0.075				0.361				0.139				0.643	0.643
29	36	2035				0.339				0.027				0.075				0.361				0.139				0.939	0.939
30	37	2036				0.042				0.027				0.075				0.361				0.139				0.643	0.643
			22.877	1.990	24.867	19.480	5.246	0.402	5.648	6.390	5.404	0.652	6.056	8.220	36.183	3.618	39.801	30.727	10.408	1.041	11.448	9.743	80.118	7.703	87.821	74.561	162.382

(1) FIRR by ODA loan

① Visual Aids to Navigation and Supporting Facilities

Necessary light dues to achieve 1.8% of FIRR (GDP: Likeliest Case) are 6.41% of light dues. It is shown in **Table 5.2.6.**

Table 5.2.6. Financial Analysis for Visual Aids to Navigation and Supporting Facilities

Light Dues 6.41% Units : Million US$

period	No	Year	Visual Aids to Navigation and Supporting Facilities							Revenue					
			Civil	Consultant	Initial Cost Total	Operating & Maintenance	Grand Total	Funds (Initial Cost) 15%	Grand Total-Funds	GDP: Likeliest Case Light Dues		GDP: Optimistic Case Light Dues		GDP: Pessimistic Case Light Dues	
			1	2	3=1+2	4	5=3+4	6=3 x 0.15	7=5-6	8	9=8-7	10	11=10-7	12	13=12-7
	1	2000													
	2	2001													
	3	2002													
	4	2003								0.973	0.973	1.015	1.015	0.931	0.931
	5	2004		0.597	0.597		0.597	0.090	0.508	1.055	0.547	1.125	0.617	0.988	0.481
	6	2005	8.832	0.398	9.230		9.230	1.384	7.845	1.144	-6.701	1.247	-6.598	1.049	-6.796
	7	2006	6.987	0.597	7.584		7.584	1.138	6.447	1.241	-5.205	1.382	-5.064	1.113	-5.333
1	8	2007	7.058	0.398	7.456		7.456	1.118	6.338	1.347	-4.991	1.533	-4.805	1.182	-5.156
2	9	2008				0.030	0.030		0.030	1.462	1.432	1.700	1.670	1.255	1.225
3	10	2009				0.082	0.082		0.082	1.586	1.505	1.886	1.804	1.332	1.250
4	11	2010				0.042	0.042		0.042	1.722	1.680	2.092	2.050	1.414	1.373
5	12	2011				0.290	0.290		0.290	1.828	1.538	2.258	1.968	1.476	1.186
6	13	2012				1.081	1.081		1.081	1.940	0.859	2.437	1.356	1.541	0.460
7	14	2013				0.082	0.082		0.082	2.059	1.977	2.630	2.548	1.608	1.526
8	15	2014				0.069	0.069		0.069	2.186	2.116	2.838	2.769	1.678	1.609
9	16	2015				0.680	0.680		0.680	2.320	1.640	3.063	2.383	1.752	1.072
10	17	2016				0.042	0.042		0.042	2.462	2.420	3.306	3.264	1.828	1.786
11	18	2017				4.149	4.149		4.149	2.614	-1.536	3.568	-0.582	1.908	-2.241
12	19	2018				0.042	0.042		0.042	2.774	2.732	3.850	3.809	1.992	1.950
13	20	2019				0.288	0.288		0.288	2.945	2.657	4.156	3.868	2.079	1.790
14	21	2020				0.042	0.042		0.042	3.126	3.084	4.485	4.443	2.170	2.128
15	22	2021				0.325	0.325		0.325	3.318	2.993	4.841	4.516	2.264	1.940
16	23	2022				1.097	1.097		1.097	3.522	2.425	5.225	4.128	2.363	1.267
17	24	2023				0.304	0.304		0.304	3.739	3.435	5.639	5.335	2.467	2.163
18	25	2024				0.042	0.042		0.042	3.969	3.927	6.087	6.045	2.575	2.533
19	26	2025				0.290	0.290		0.290	4.213	3.923	6.570	6.280	2.687	2.397
20	27	2026				0.042	0.042		0.042	4.472	4.430	7.091	7.049	2.805	2.763
21	28	2027				7.992	7.992		7.992	4.747	-3.245	7.654	-0.338	2.928	-5.065
22	29	2028				0.025	0.025		0.025	5.039	5.014	8.262	8.236	3.056	3.031
23	30	2029				0.290	0.290		0.290	5.349	5.059	8.918	8.628	3.190	2.900
24	31	2030				0.042	0.042		0.042	5.679	5.637	9.626	9.584	3.329	3.287
25	32	2031				0.304	0.304		0.304	6.028	5.724	10.390	10.086	3.475	3.171
26	33	2032				1.097	1.097		1.097	6.399	5.302	11.216	10.119	3.627	2.530
27	34	2033				0.289	0.289		0.289	6.793	6.504	12.106	11.817	3.786	3.497
28	35	2034				0.042	0.042		0.042	7.211	7.170	13.068	13.026	3.952	3.910
29	36	2035				0.339	0.339		0.339	7.656	7.317	14.107	13.768	4.125	3.786
30	37	2036				0.042	0.042		0.042	8.127	8.085	15.227	15.186	4.306	4.264
			22.877	1.990	24.867	19.480	44.347	3.730	40.617	121.044	80.427	190.597	149.980	78.231	37.614
						FIRR					1.80%		3.52%		-0.19%

② DGPS

Necessary light dues to achieve 1.8% of FIRR (GDP: Likeliest Case) are 1.64% of light dues. It is shown in **Table 5.2.7.**

Table 5.2.7. Financial Analysis for DGPS

Light Dues 1.64% Units : Million US$

period	No	Year	TTL Cost (DGPS)							Revenue					
			Civil	Consultant	Initial Cost Total	Operating & Maintenance	Grand Total	Funds (Initial Cost) 15%	Grand Total-Funds	GDP: Likeliest Case Light Dues		GDP: Optimistic Case Light Dues		GDP: Pessimistic Case Light Dues	
			1	2	3=1+2	4	5=3+4	6=3 x 0.15	7=5-6	8	9=8-7	10	11=10-7	12	13=12-7
	1	2000													
	2	2001													
	3	2002													
	4	2003								0.249	0.249	0.260	0.260	0.239	0.239
	5	2004								0.271	0.271	0.289	0.289	0.253	0.253
	6	2005								0.293	0.293	0.320	0.320	0.269	0.269
	7	2006		0.161	0.161		0.161	0.024	0.137	0.318	0.182	0.355	0.218	0.286	0.149
1	8	2007	4.681	0.121	4.801		4.801	0.720	4.081	0.345	-3.736	0.393	-3.688	0.303	-3.778
2	9	2008	0.565	0.121	0.686		0.686	0.10288	0.583	0.375	-0.208	0.436	-0.147	0.322	-0.261
3	10	2009				0.027	0.027		0.027	0.407	0.380	0.484	0.457	0.342	0.315
4	11	2010				0.027	0.027		0.027	0.442	0.415	0.536	0.510	0.363	0.336
5	12	2011				0.027	0.027		0.027	0.469	0.442	0.579	0.552	0.379	0.352
6	13	2012				0.027	0.027		0.027	0.497	0.471	0.625	0.598	0.395	0.369
7	14	2013				0.027	0.027		0.027	0.528	0.502	0.674	0.648	0.412	0.386
8	15	2014				0.027	0.027		0.027	0.560	0.534	0.728	0.701	0.430	0.404
9	16	2015				0.027	0.027		0.027	0.595	0.568	0.785	0.759	0.449	0.423
10	17	2016				0.027	0.027		0.027	0.631	0.605	0.848	0.821	0.469	0.442
11	18	2017				0.027	0.027		0.027	0.670	0.644	0.915	0.888	0.489	0.463
12	19	2018				0.027	0.027		0.027	0.711	0.685	0.987	0.961	0.511	0.484
13	20	2019				0.027	0.027		0.027	0.755	0.729	1.066	1.039	0.533	0.507
14	21	2020				0.027	0.027		0.027	0.802	0.775	1.150	1.124	0.556	0.530
15	22	2021				0.187	0.187		0.187	0.851	0.664	1.241	1.054	0.581	0.394
16	23	2022				4.828	4.828		4.828	0.903	-3.925	1.340	-3.488	0.606	-4.222
17	24	2023				0.712	0.712		0.712	0.959	0.246	1.446	0.734	0.633	-0.080
18	25	2024				0.027	0.027		0.027	1.018	0.991	1.561	1.534	0.660	0.634
19	26	2025				0.027	0.027		0.027	1.080	1.054	1.685	1.658	0.689	0.663
20	27	2026				0.027	0.027		0.027	1.147	1.120	1.819	1.792	0.719	0.693
21	28	2027				0.027	0.027		0.027	1.217	1.191	1.963	1.936	0.751	0.724
22	29	2028				0.027	0.027		0.027	1.292	1.266	2.119	2.092	0.784	0.757
23	30	2029				0.027	0.027		0.027	1.372	1.345	2.287	2.260	0.818	0.791
24	31	2030				0.027	0.027		0.027	1.456	1.430	2.469	2.442	0.854	0.827
25	32	2031				0.027	0.027		0.027	1.546	1.519	2.665	2.638	0.891	0.865
26	33	2032				0.027	0.027		0.027	1.641	1.615	2.876	2.850	0.930	0.904
27	34	2033				0.027	0.027		0.027	1.742	1.716	3.105	3.078	0.971	0.944
28	35	2034				0.027	0.027		0.027	1.849	1.823	3.351	3.325	1.013	0.987
29	36	2035				0.027	0.027		0.027	1.963	1.937	3.618	3.591	1.058	1.031
30	37	2036				0.027	0.027		0.027	2.084	2.058	3.905	3.879	1.104	1.078
			5.246	0.402	5.648	6.390	12.038	0.847	11.191	31.042	19.851	48.879	37.688	20.062	8.871
						FIRR					1.80%		4.01%		-0.66%

③ VTS System

Necessary light dues to achieve 1.8% of FIRR (GDP: Likeliest Case) are 2.03% of light dues. It is shown **in Table 5.2.8**.

Table 5.2.8. Financial Analysis for VTS System

Light Dues 2.03% Units : Million US$

period	No	Year	TTL Cost (VTS System)							Revenue					
			Civil	Consultant	Initial Cost Total	Operating & Maintenance	Grand Total	Funds (Initial Cost) 15%	Grand Total-Funds	GDP: Likeliest Case		GDP: Optimistic Case		GDP: Pessimistic Case	
										Light Dues		Light Dues		Light Dues	
			1	2	3=1+2	4	5=3+4	6=3 x 0.15	7=5-6	8	9=8-7	10	11=10-7	12	13=12-7
	1	2000													
	2	2001													
	3	2002													
	4	2003								0.308	0.308	0.322	0.322	0.295	0.295
	5	2004	0.952	0.261	1.213		1.213	0.182	1.031	0.334	-0.697	0.356	-0.675	0.313	-0.718
	6	2005	1.622	0.195	1.817		1.817	0.273	1.545	0.363	-1.182	0.395	-1.150	0.332	-1.212
	7	2006	2.290	0.130	2.420		2.420	0.363	2.057	0.393	-1.664	0.438	-1.619	0.353	-1.705
1	8	2007	0.540	0.065	0.605		0.605	0.091	0.514	0.427	-0.088	0.486	-0.029	0.374	-0.140
2	9	2008				0.075	0.075		0.075	0.463	0.388	0.539	0.464	0.398	0.323
3	10	2009				0.075	0.075		0.075	0.503	0.428	0.597	0.523	0.422	0.347
4	11	2010				0.075	0.075		0.075	0.546	0.471	0.663	0.588	0.448	0.373
5	12	2011				0.075	0.075		0.075	0.579	0.504	0.715	0.641	0.468	0.393
6	13	2012				0.075	0.075		0.075	0.615	0.540	0.772	0.697	0.488	0.413
7	14	2013				0.075	0.075		0.075	0.652	0.578	0.833	0.758	0.509	0.435
8	15	2014				0.075	0.075		0.075	0.692	0.618	0.899	0.824	0.532	0.457
9	16	2015				0.075	0.075		0.075	0.735	0.660	0.970	0.896	0.555	0.480
10	17	2016				0.075	0.075		0.075	0.780	0.705	1.047	0.973	0.579	0.505
11	18	2017				0.075	0.075		0.075	0.828	0.753	1.130	1.056	0.605	0.530
12	19	2018				0.075	0.075		0.075	0.879	0.804	1.220	1.145	0.631	0.556
13	20	2019				1.288	1.288		1.288	0.933	-0.355	1.317	0.029	0.659	-0.629
14	21	2020				1.892	1.892		1.892	0.990	-0.902	1.421	-0.471	0.687	-1.205
15	22	2021				2.495	2.495		2.495	1.051	-1.444	1.534	-0.961	0.717	-1.778
16	23	2022				0.680	0.680		0.680	1.116	0.436	1.655	0.975	0.749	0.069
17	24	2023				0.075	0.075		0.075	1.184	1.110	1.787	1.712	0.782	0.707
18	25	2024				0.075	0.075		0.075	1.257	1.183	1.928	1.854	0.816	0.741
19	26	2025				0.075	0.075		0.075	1.335	1.260	2.081	2.007	0.851	0.777
20	27	2026				0.075	0.075		0.075	1.417	1.342	2.247	2.172	0.889	0.814
21	28	2027				0.075	0.075		0.075	1.504	1.429	2.425	2.350	0.928	0.853
22	29	2028				0.075	0.075		0.075	1.596	1.522	2.617	2.543	0.968	0.894
23	30	2029				0.075	0.075		0.075	1.695	1.620	2.825	2.751	1.011	0.936
24	31	2030				0.075	0.075		0.075	1.799	1.724	3.050	2.975	1.055	0.980
25	32	2031				0.075	0.075		0.075	1.910	1.835	3.292	3.217	1.101	1.026
26	33	2032				0.075	0.075		0.075	2.027	1.953	3.553	3.479	1.149	1.075
27	34	2033				0.075	0.075		0.075	2.152	2.078	3.835	3.761	1.199	1.125
28	35	2034				0.075	0.075		0.075	2.285	2.210	4.140	4.066	1.252	1.177
29	36	2035				0.075	0.075		0.075	2.425	2.351	4.469	4.395	1.307	1.232
30	37	2036				0.075	0.075		0.075	2.575	2.500	4.824	4.750	1.364	1.289
			5.404	0.652	6.056	8.220	14.276	0.908	13.368	38.348	24.981	60.384	47.016	24.785	11.417
						FIRR					1.80%		3.74%		-0.42%

④ GMDSS

Necessary light dues to achieve 1.8% of FIRR (GDP: Likeliest Case) are 10.49% of light dues. It is shown in **Table 5.2.9.**

Table 5.2.9. Financial Analysis for GMDSS

Light Dues 10.49% Units : Million US$

period	No	Year	TTL Cost (GMDSS)							Revenue					
			Civil	Consultant	Initial Cost Total	Operating & Maintenance	Grand Total	Funds (Initial Cost) 15%	Grand Total-Funds	GDP: Likeliest Case		GDP: Optimistic Case		GDP: Pessimistic Case	
										Light Dues		Light Dues		Light Dues	
			1	2	3=1+2	4	5=3+4	6=3 x 0.15	7=5-6	8	9=8-7	10	11=10-7	12	13=12-7
	1	2000													
	2	2001													
	3	2002													
	4	2003		0.689	0.689		0.689	0.103	0.586	1.591	1.006	1.661	1.075	1.524	0.938
	5	2004		0.862	0.862		0.862	0.129	0.732	1.726	0.994	1.841	1.108	1.617	0.885
	6	2005	13.784	0.862	14.646		14.646	2.197	12.449	1.872	-10.577	2.040	-10.409	1.716	-10.733
	7	2006	15.507	0.689	16.196		16.196	2.429	13.767	2.031	-11.736	2.261	-11.505	1.821	-11.945
1	8	2007	6.892	0.517	7.409	0.361	7.770	1.111	6.658	2.203	-4.455	2.507	-4.151	1.933	-4.725
2	9	2008				0.361	0.361		0.361	2.391	2.030	2.781	2.420	2.053	1.692
3	10	2009				0.361	0.361		0.361	2.595	2.234	3.085	2.724	2.179	1.818
4	11	2010				0.361	0.361		0.361	2.817	2.456	3.422	3.061	2.314	1.953
5	12	2011				0.361	0.361		0.361	2.990	2.629	3.693	3.332	2.415	2.054
6	13	2012				0.361	0.361		0.361	3.174	2.813	3.986	3.625	2.520	2.160
7	14	2013				0.361	0.361		0.361	3.368	3.008	4.302	3.941	2.631	2.270
8	15	2014				0.361	0.361		0.361	3.575	3.214	4.643	4.282	2.745	2.385
9	16	2015				0.361	0.361		0.361	3.795	3.434	5.010	4.650	2.865	2.505
10	17	2016				0.361	0.361		0.361	4.028	3.667	5.408	5.047	2.991	2.630
11	18	2017				0.361	0.361		0.361	4.276	3.915	5.836	5.475	3.121	2.761
12	19	2018				0.706	0.706		0.706	4.539	3.833	6.299	5.593	3.258	2.552
13	20	2019				0.792	0.792		0.792	4.817	4.026	6.798	6.007	3.400	2.609
14	21	2020				7.684	7.684		7.684	5.114	-2.570	7.337	-0.346	3.549	-4.134
15	22	2021				8.459	8.459		8.459	5.428	-3.031	7.919	-0.540	3.704	-4.755
16	23	2022				4.065	4.065		4.065	5.762	1.696	8.548	4.482	3.866	-0.199
17	24	2023				0.361	0.361		0.361	6.116	5.755	9.226	8.865	4.035	3.675
18	25	2024				0.361	0.361		0.361	6.492	6.131	9.958	9.597	4.212	3.851
19	26	2025				0.361	0.361		0.361	6.892	6.531	10.748	10.387	4.396	4.035
20	27	2026				0.361	0.361		0.361	7.316	6.955	11.601	11.240	4.589	4.228
21	28	2027				0.361	0.361		0.361	7.766	7.405	12.522	12.161	4.789	4.429
22	29	2028				0.361	0.361		0.361	8.244	7.883	13.516	13.155	4.999	4.638
23	30	2029				0.361	0.361		0.361	8.751	8.390	14.589	14.228	5.218	4.857
24	31	2030				0.361	0.361		0.361	9.289	8.929	15.747	15.386	5.446	5.085
25	32	2031				0.361	0.361		0.361	9.861	9.500	16.998	16.637	5.685	5.324
26	33	2032				0.361	0.361		0.361	10.468	10.107	18.348	17.987	5.934	5.573
27	34	2033				0.361	0.361		0.361	11.113	10.752	19.805	19.444	6.194	5.833
28	35	2034				0.361	0.361		0.361	11.797	11.436	21.378	21.017	6.465	6.104
29	36	2035				0.361	0.361		0.361	12.524	12.163	23.077	22.716	6.748	6.387
30	37	2036				0.361	0.361		0.361	13.295	12.934	24.911	24.550	7.044	6.683
			36.183	3.618	39.801	30.727	70.529	5.970	64.559	198.016	133.458	311.798	247.239	127.978	63.420
						FIRR					1.80%		3.47%		-0.04%

⑤ Ship Reporting System

Necessary light dues to achieve 1.8% of FIRR (GDP: Likeliest Case) are 3.00% of light dues. It is shown in **Table 5.2.10.**

Table 5.2.10. Financial Analysis for Ship Reporting System

Light Dues 3.00% Units : Million US$

period	No	Year	TTL Cost (Ship Reporting System)							Revenue					
			Civil	Consultant	Initial Cost Total	Operating & Maintenance	Grand Total	Funds (Initial Cost) 15%	Grand Total-Funds	GDP: Likeliest Case		GDP: Optimistic Case		GDP: Pessimistic Case	
										Light Dues		Light Dues		Light Dues	
			1	2	3=1+2	4	5=3+4	6=3 x 0.15	7=5-6	8	9=8-7	10	11=10-7	12	13=12-7
	1	2000													
	2	2001													
	3	2002													
	4	2003								0.455	0.455	0.475	0.475	0.435	0.435
	5	2004								0.493	0.493	0.526	0.526	0.462	0.462
	6	2005		0.297	0.297		0.297	0.045	0.253	0.535	0.282	0.583	0.330	0.490	0.237
	7	2006	1.982	0.297	2.280		2.280	0.342	1.938	0.580	-1.358	0.646	-1.292	0.520	-1.418
1	8	2007	5.452	0.297	5.749		5.749	0.862	4.887	0.629	-4.257	0.716	-4.170	0.552	-4.334
2	9	2008	2.974	0.149	3.122	0.139	3.261	0.46834	2.793	0.683	-2.109	0.794	-1.998	0.586	-2.206
3	10	2009				0.139	0.139		0.139	0.741	0.603	0.881	0.743	0.622	0.484
4	11	2010				0.139	0.139		0.139	0.805	0.666	0.978	0.839	0.661	0.522
5	12	2011				0.139	0.139		0.139	0.854	0.715	1.055	0.916	0.690	0.551
6	13	2012				0.139	0.139		0.139	0.907	0.768	1.139	1.000	0.720	0.581
7	14	2013				0.139	0.139		0.139	0.962	0.824	1.229	1.090	0.751	0.613
8	15	2014				0.139	0.139		0.139	1.021	0.883	1.326	1.188	0.784	0.646
9	16	2015				0.139	0.139		0.139	1.084	0.945	1.431	1.293	0.819	0.680
10	17	2016				0.139	0.139		0.139	1.151	1.012	1.545	1.406	0.854	0.716
11	18	2017				0.139	0.139		0.139	1.221	1.083	1.667	1.529	0.892	0.753
12	19	2018				0.139	0.139		0.139	1.296	1.158	1.799	1.661	0.931	0.792
13	20	2019				0.139	0.139		0.139	1.376	1.238	1.942	1.803	0.971	0.833
14	21	2020				0.287	0.287		0.287	1.461	1.173	2.096	1.809	1.014	0.727
15	22	2021				1.278	1.278		1.278	1.551	0.272	2.262	0.984	1.058	-0.220
16	23	2022				3.013	3.013		3.013	1.646	-1.367	2.442	-0.571	1.104	-1.909
17	24	2023				1.700	1.700		1.700	1.747	0.047	2.635	0.936	1.153	-0.547
18	25	2024				0.139	0.139		0.139	1.855	1.716	2.844	2.706	1.203	1.065
19	26	2025				0.139	0.139		0.139	1.969	1.830	3.070	2.932	1.256	1.117
20	27	2026				0.139	0.139		0.139	2.090	1.951	3.314	3.175	1.311	1.172
21	28	2027				0.139	0.139		0.139	2.218	2.080	3.577	3.438	1.368	1.230
22	29	2028				0.139	0.139		0.139	2.355	2.216	3.861	3.722	1.428	1.289
23	30	2029				0.139	0.139		0.139	2.500	2.361	4.167	4.029	1.491	1.352
24	31	2030				0.139	0.139		0.139	2.654	2.515	4.498	4.360	1.556	1.417
25	32	2031				0.139	0.139		0.139	2.817	2.678	4.855	4.717	1.624	1.485
26	33	2032				0.139	0.139		0.139	2.990	2.852	5.241	5.102	1.695	1.556
27	34	2033				0.139	0.139		0.139	3.174	3.036	5.657	5.519	1.769	1.631
28	35	2034				0.139	0.139		0.139	3.370	3.231	6.107	5.968	1.847	1.708
29	36	2035				0.139	0.139		0.139	3.577	3.439	6.592	6.453	1.928	1.789
30	37	2036				0.139	0.139		0.139	3.798	3.659	7.116	6.977	2.012	1.873
			10.408	1.041	11.448	9.743	21.192	1.717	19.475	56.564	37.090	89.066	69.592	36.558	17.083
						FIRR					1.80%		3.72%		-0.34%

⑥ Summary

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 5.2.11.**

Summary of necessary funds is shown in **Table 5.2.12.**

Table 5.2.11. Financial Analysis for Total Projects

Light Dues 23.57% Units : Million US$

period	No	Year	TTL Cost (All Projects)							Revenue					
			Civil	Consultant	Initial Cost Total	Operating & Maintenance	Grand Total	Funds (Initial Cost)	Loan (Initial Cost)	GDP: Likeliest Case		GDP: Optimistic Case		GDP: Pessimistic Case	
								15%	85%	Light Dues		Light Dues		Light Dues	
			1	2	3=1+2	4	5=3+4	6	7=5-6	8	9=8-7	10	11=10-7	12	13=12-7
	1	2000													
	2	2001													
	3	2002													
	4	2003		0.689	0.689		0.689	0.103	0.586	3.576	2.991	3.733	3.147	3.424	2.838
	5	2004	0.952	1.720	2.672		2.672	0.401	2.271	3.879	1.608	4.137	1.866	3.634	1.363
	6	2005	24.238	1.752	25.990		25.990	3.898	22.091	4.207	-17.884	4.585	-17.507	3.857	-18.235
	7	2006	26.767	1.875	28.641		28.641	4.296	24.345	4.564	-19.781	5.082	-19.263	4.093	-20.252
1	8	2007	24.623	1.398	26.021	0.361	26.381	3.903	22.478	4.952	-17.526	5.635	-16.843	4.345	-18.133
2	9	2008	3.539	0.269	3.808	0.604	4.412	0.571	3.841	5.374	1.533	6.249	2.409	4.613	0.772
3	10	2009				0.682	0.682		0.682	5.832	5.150	6.932	6.250	4.897	4.215
4	11	2010				0.643	0.643		0.643	6.331	5.688	7.691	7.049	5.200	4.557
5	12	2011				0.891	0.891		0.891	6.719	5.829	8.300	7.409	5.427	4.536
6	13	2012				1.681	1.681		1.681	7.132	5.451	8.958	7.276	5.664	3.983
7	14	2013				0.682	0.682		0.682	7.570	6.888	9.667	8.985	5.912	5.229
8	15	2014				0.670	0.670		0.670	8.035	7.365	10.433	9.763	6.170	5.500
9	16	2015				1.281	1.281		1.281	8.529	7.248	11.260	9.979	6.440	5.159
10	17	2016				0.643	0.643		0.643	9.053	8.410	12.153	11.510	6.721	6.079
11	18	2017				4.750	4.750		4.750	9.609	4.859	13.116	8.366	7.015	2.265
12	19	2018				0.987	0.987		0.987	10.200	9.212	14.156	13.169	7.322	6.335
13	20	2019				2.532	2.532		2.532	10.826	8.294	15.278	12.746	7.642	5.109
14	21	2020				9.931	9.931		9.931	11.492	1.561	16.490	6.558	7.976	-1.955
15	22	2021				12.744	12.744		12.744	12.199	-0.546	17.797	5.053	8.325	-4.420
16	23	2022				13.683	13.683		13.683	12.949	-0.734	19.209	5.526	8.689	-4.994
17	24	2023				3.152	3.152		3.152	13.745	10.593	20.733	17.581	9.069	5.917
18	25	2024				0.643	0.643		0.643	14.590	13.948	22.378	21.736	9.466	8.823
19	26	2025				0.891	0.891		0.891	15.488	14.597	24.154	23.263	9.880	8.989
20	27	2026				0.643	0.643		0.643	16.441	15.798	26.071	25.428	10.312	9.670
21	28	2027				8.593	8.593		8.593	17.452	8.859	28.140	19.547	10.764	2.171
22	29	2028				0.626	0.626		0.626	18.526	17.900	30.374	29.748	11.235	10.609
23	30	2029				0.891	0.891		0.891	19.666	18.775	32.786	31.895	11.726	10.836
24	31	2030				0.643	0.643		0.643	20.877	20.234	35.389	34.746	12.240	11.597
25	32	2031				0.905	0.905		0.905	22.162	21.257	38.199	37.294	12.776	11.871
26	33	2032				1.697	1.697		1.697	23.526	21.829	41.233	39.536	13.335	11.638
27	34	2033				0.890	0.890		0.890	24.975	24.085	44.509	43.619	13.919	13.029
28	35	2034				0.643	0.643		0.643	26.512	25.870	48.044	47.402	14.529	13.886
29	36	2035				0.939	0.939		0.939	28.145	27.206	51.862	50.922	15.165	14.226
30	37	2036				0.643	0.643		0.643	29.879	29.236	55.983	55.340	15.829	15.187
			80.118	7.703	87.821	74.561	162.382	13.173	149.209	445.010	295.801	700.716	551.507	287.610	138.401
									FIRR		1.80%		3.56%		-0.18%

Table 5.2.12. Summary of Necessary Funds

Units : Million US$

	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	6.056	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	87.821	23.57%

(2) FIRR by Market Interest Rate (6 %)

Assuming that 85% of total amount of investments (foreign cost + local cost) is loaned to GOI to compare with FIRR by ODA loan, necessary light dues should be calculated. FIRR by market interest rate (GDP: Likeliest Case, Evaluation Period: 10 years) is shown in **Appendix 5.2.1**, **Appendix 5.2.2**, **Appendix 5.2.3**, **Appendix 5.2.4**, **Appendix 5.2.5** and **Appendix 5.2.6**. FIRR by market interest rate (GDP: Likeliest Case, Evaluation Period: 30 years) is shown in **Appendix 5.2.7**, **Appendix 5.2.8**, **Appendix 5.2.9**, **Appendix 5.2.10**, **Appendix 5.2.11** and **Appendix 5.2.12**.

Necessary light dues to achieve 6.0% of FIRR (GDP: Likeliest Case) are summarized in **Table 5.2.13.**

Table 5.2.13 Summary of Necessary Light Dues by Market Interest Rate

Unit: %

	Necessary Light Dues					
	GDP: Likeliest Case		GDP: Optimistic Case		GDP: Pessimistic Case	
Evaluation Period	10 Years	30 Years	10 Years	30 Years	10 Years	30 Years
Visual Aids to Navigation and Supporting Facilities	19.78%	13.74%	16.76%	10.41%	23.24%	17.74%
DGPS	3.78%	2.89%	3.21%	2.19%	4.44%	3.73%
VTS System	5.15%	3.96%	4.37%	3.00%	6.05%	5.11%
GMDSS	32.40%	22.82%	27.46%	17.29%	38.07%	29.46%
Ship Reporting System	8.14%	5.78%	6.90%	4.38%	9.56%	7.46%
Total	69.25%	49.19%	58.69%	37.27%	81.36%	63.50%

5.2.7. Sensitive Analysis for ODA Loan

Sensitive analysis for ODA loan should be implemented among three GDP 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 5.2.14**.

Table 5.2.14. Sensitive Analysis

	Necessary Light Dues		
	GDP: Likeliest Case	GDP:Optimistic Case	GDP: Pessimistic Case
Visual Aids to Navigation and Supporting Facilities	6.41%	4.28%	9.39%
DGPS	1.64%	1.10%	2.41%
VTS System	2.03%	1.35%	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%

5.3 Recommendable Priority Projects

5.3.1. 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 5.3.1.**

Table 5.3.1. 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%	3.73%
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	**87.821**	**74.561**			**23.57%**	15.72%	34.54%	**49.19%**	37.27%	63.50%
	162.382 Million US $									

5.3.2. 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, II and III 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 to 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.

5.3.3. 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 5.3.2** and **Table 5.3.3**

Table 5.3.2. Result on Economic and Financi al 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	12.0%	NA	**6.41%**	4.28%	9.39%	**13.74%**	10.41%	17.74%
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	**82.172**	**68.170**			**21.93%**	14.63%	32.13%	**46.30%**	35.08%	59.72%
	150.342 Million US $									

Table 5.3.3. 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%**

Table 5.3.4. shows the result of recalculation of FIRR for whole of recommendable Priority Projects based on the yearly investment amount of **21.93%** of Light Dues Revenue Prospect in GDP likeliest case.

Table 5.3.4. FIRR Calculation for Recommendable Priority Projects Based on 21.93% of Light Dues Revenue Prospect in GDP Likeliest Case

Light Dues 21.93% Units : Million US$

periode	No	Year	TTL Cost (All Projects)							Revenue					
			Civil	Consultant	Initial Cost Total	Operating & Maintenance	Grand Total	Funds (Initial Cost) 15%	Loan (Initial Cost) 85%	GDP: Likeliest Case Light Dues		GDP: Optimistic Case Light Dues		GDP: Pesimistic Case Light Dues	
			1	2	3=1+2	4	5=3+4	6	7=5-6	8	9=8-7	10	11=10-7	12	13=12-7
	1	2000													
	2	2001													
	3	2002													
	4	2003		0.689	0.689		0.689	0.103	0.586	3.327	2.741	3.473	2.887	3.186	2.600
	5	2004	0.952	1.719	2.671		2.671	0.401	2.270	3.608	1.338	3.848	1.578	3.381	1.110
	6	2005	24.238	1.752	25.990		25.990	3.898	22.091	3.914	-18.177	4.265	-17.826	3.588	-18.503
	7	2006	26.767	1.714	28.481		28.481	4.272	24.209	4.246	-19.963	4.728	-19.481	3.808	-20.401
1	8	2007	19.942	1.277	21.219	0.361	21.580	3.183	18.397	4.607	-13.790	5.242	-13.155	4.042	-14.355
2	9	2008	2.974	0.149	3.122	0.604	3.726	0.468	3.258	4.999	1.742	5.814	2.556	4.291	1.034
3	10	2009				0.656	0.656		0.656	5.426	4.770	6.449	5.793	4.556	3.900
4	11	2010				0.616	0.616		0.616	5.889	5.273	7.155	6.539	4.838	4.222
5	12	2011				0.864	0.864		0.864	6.251	5.387	7.722	6.858	5.049	4.185
6	13	2012				1.655	1.655		1.655	6.635	4.980	8.333	6.679	5.269	3.615
7	14	2013				0.656	0.656		0.656	7.042	6.387	8.994	8.338	5.500	4.844
8	15	2014				0.643	0.643		0.643	7.475	6.832	9.706	9.063	5.740	5.097
9	16	2015				1.254	1.254		1.254	7.934	6.680	10.475	9.221	5.991	4.737
10	17	2016				0.616	0.616		0.616	8.422	7.806	11.306	10.690	6.253	5.637
11	18	2017				4.724	4.724		4.724	8.939	4.216	12.202	7.478	6.526	1.803
12	19	2018				0.961	0.961		0.961	9.489	8.528	13.169	12.209	6.811	5.851
13	20	2019				2.505	2.505		2.505	10.072	7.567	14.213	11.708	7.109	4.604
14	21	2020				9.905	9.905		9.905	10.691	0.786	15.340	5.436	7.420	-2.484
15	22	2021				12.557	12.557		12.557	11.348	-1.209	16.557	4.000	7.745	-4.813
16	23	2022				8.855	8.855		8.855	12.046	3.191	17.870	9.015	8.083	-0.772
17	24	2023				2.439	2.439		2.439	12.787	10.348	19.288	16.849	8.437	5.998
18	25	2024				0.616	0.616		0.616	13.574	12.958	20.819	20.203	8.806	8.190
19	26	2025				0.864	0.864		0.864	14.409	13.544	22.471	21.606	9.191	8.327
20	27	2026				0.616	0.616		0.616	15.295	14.679	24.254	23.638	9.594	8.978
21	28	2027				8.566	8.566		8.566	16.236	7.669	26.179	17.613	10.013	1.447
22	29	2028				0.600	0.600		0.600	17.235	16.635	28.257	27.658	10.452	9.852
23	30	2029				0.864	0.864		0.864	18.296	17.431	30.501	29.636	10.909	10.045
24	31	2030				0.616	0.616		0.616	19.422	18.806	32.923	32.307	11.387	10.771
25	32	2031				0.878	0.878		0.878	20.617	19.739	35.537	34.659	11.885	11.007
26	33	2032				1.671	1.671		1.671	21.887	20.216	38.360	36.689	12.406	10.735
27	34	2033				0.863	0.863		0.863	23.234	22.371	41.407	40.543	12.949	12.086
28	35	2034				0.616	0.616		0.616	24.665	24.049	44.696	44.080	13.516	12.900
29	36	2035				0.913	0.913		0.913	26.184	25.271	48.248	47.335	14.108	13.195
30	37	2036				0.616	0.616		0.616	27.796	27.180	52.081	51.465	14.726	14.110
			74.872	7.300	82.172	68.171	150.343	12.326	138.017	413.997	275.980	651.883	513.866	267.567	129.550
									FIRR		1.80%		3.54%		-0.15%

Table 5.3.5. shows the result of recalculation of FIRR for whole of recommendable Priority Projects based on the yearly investment amount of **46.30%** of Light Dues Revenue Prospect in GDP likeliest case.

Table 5.3.5. FIRR Calculation for Recommendable Priority Projects Based on 46.3% of Light Dues Revenue Prospect in GDP Likeliest Case

Light Dues 46.30% Units : Million US$

periode	No	Year	TTL Cost (All Projects)							Revenue					
			Civil	Consultant	Initial Cost Total	Operating & Maintenance	Grand Total	Funds (Initial Cost)	Loan (Initial Cost)	GDP: Likeliest Case		GDP: Optimistic Case		GDP: Pesimistic Case	
								15%	85%	Light Dues		Light Dues		Light Dues	
			1	2	3=1+2	4	5=3+4	6	7=5-6	8	9=8-7	10	11=10-7	12	13=12-7
	1	2000													
	2	2001													
	3	2002													
	4	2003		0.689	0.689		0.689	0.103	0.586	7.026	6.440	7.334	6.748	6.727	6.141
	5	2004	0.952	1.719	2.671		2.671	0.401	2.270	7.620	5.350	8.127	5.856	7.139	4.869
	6	2005	24.238	1.752	25.990		25.990	3.898	22.091	8.265	-13.826	9.007	-13.085	7.577	-14.515
	7	2006	26.767	1.714	28.481		28.481	4.272	24.209	8.966	-15.242	9.984	-14.224	8.042	-16.167
1	8	2007	19.942	1.277	21.219	0.361	21.580	3.183	18.397	9.728	-8.669	11.071	-7.327	8.536	-9.861
2	9	2008	2.974	0.149	3.122	0.604	3.726	0.468	3.258	10.557	7.299	12.278	9.020	9.062	5.805
3	10	2009				0.656	0.656		0.656	11.458	10.802	13.619	12.963	9.621	8.965
4	11	2010				0.616	0.616		0.616	12.437	11.821	15.110	14.494	10.216	9.600
5	12	2011				0.864	0.864		0.864	13.201	12.336	16.306	15.442	10.662	9.798
6	13	2012				1.655	1.655		1.655	14.011	12.357	17.598	15.943	11.128	9.473
7	14	2013				0.656	0.656		0.656	14.872	14.216	18.992	18.336	11.614	10.958
8	15	2014				0.643	0.643		0.643	15.785	15.142	20.497	19.854	12.122	11.478
9	16	2015				1.254	1.254		1.254	16.755	15.501	22.121	20.867	12.651	11.397
10	17	2016				0.616	0.616		0.616	17.785	17.169	23.875	23.259	13.204	12.588
11	18	2017				4.724	4.724		4.724	18.878	14.154	25.767	21.044	13.782	9.058
12	19	2018				0.961	0.961		0.961	20.038	19.077	27.810	26.849	14.384	13.423
13	20	2019				2.505	2.505		2.505	21.269	18.765	30.015	27.510	15.013	12.508
14	21	2020				9.905	9.905		9.905	22.577	12.672	32.395	22.490	15.670	5.765
15	22	2021				12.557	12.557		12.557	23.965	11.408	34.964	22.407	16.355	3.798
16	23	2022				8.855	8.855		8.855	25.439	16.584	37.738	28.883	17.070	8.215
17	24	2023				2.439	2.439		2.439	27.003	24.564	40.732	38.292	17.817	15.378
18	25	2024				0.616	0.616		0.616	28.664	28.048	43.964	43.347	18.596	17.980
19	26	2025				0.864	0.864		0.864	30.427	29.563	47.452	46.588	19.410	18.546
20	27	2026				0.616	0.616		0.616	32.299	31.683	51.218	50.602	20.259	19.643
21	28	2027				8.566	8.566		8.566	34.286	25.720	55.284	46.717	21.146	12.579
22	29	2028				0.600	0.600		0.600	36.396	35.796	59.672	59.073	22.071	21.472
23	30	2029				0.864	0.864		0.864	38.636	37.772	64.410	63.546	23.038	22.173
24	31	2030				0.616	0.616		0.616	41.014	40.398	69.524	68.908	24.046	23.430
25	32	2031				0.878	0.878		0.878	43.538	42.660	75.045	74.167	25.099	24.221
26	33	2032				1.671	1.671		1.671	46.219	44.548	81.006	79.335	26.198	24.527
27	34	2033				0.863	0.863		0.863	49.064	48.201	87.440	86.577	27.345	26.482
28	35	2034				0.616	0.616		0.616	52.086	51.470	94.387	93.771	28.543	27.927
29	36	2035				0.913	0.913		0.913	55.293	54.380	101.886	100.974	29.793	28.880
30	37	2036				0.616	0.616		0.616	58.699	58.083	109.983	109.367	31.098	30.482
			74.872	7.300	82.172	68.171	150.343	12.326	138.017	874.257	736.240	1,376.611	1,238.594	565.033	427.016
									FIRR		6.00%		7.98%		4.00%

CHAPTER 6.

RECOMMENDATION OF PROGRAM FOR MANAGEMENT AND MANTENANCE

CHAPTER 6.
RECOMMENDATION OF PROGRAM FOR MANAGEMENT AND MAINTENANCE

6.1. Aids to Navigation System

6.1.1. Problems on Management and Maintenance

The site surveys were executed for fourteen (14) District of Navigation Offices (DISNAV/Sub DISNAV), several aids to navigation and their supporting facilities. The questionnaires were sent to twenty-four (24) District of Navigation Offices to confirm the current situation of aids to navigation and their supporting facilities.

The problems on management and maintenance for aids to navigation were confirmed through the site survey and questionnaires as follows:

(1) Long time lag of notification on a lights to mariners

There are some visual aids to navigation that have a long time lag to record or delete Light Number to be given to a light own on List of Light.

(2) Availability/reliability of lights

There are some responsibility areas for operation and maintenance of District of Navigation Offices that have an averaged index below ninety-five (95)%. The figures show the availability/reliability of lights.

The absolute minimum level of availability/reliability should be set at 95%.

The causes of failures of lights were mainly theft, collision by boat, collapse, sinking or drifting, shortage of spare parts, limited budget and lack of information.

(3) Shortage of spare parts

There are many lights that have malfunction such as light failure owing to shortage of spare parts for lighting equipment and power supply system and so forth.

(4) Limitation of vessels available for aids to navigation services

Supporting services of many vessels for aids to navigation are limited owing to old age, difficulty of procurement of fuel, shortage of spare parts and so forth.

(5) Maintaining notification on visual aids to navigation

It is very important that visual aids to navigation must be maintained in compliance with notification in List of Light, such as range of light and so forth.

The following lights are found:

- Some lights whose lenses were painted red,
- Light buoy without light, which is an obstruction to mariners at night,
- Some lateral marks that surface color to be specified based on IALA maritime voyage system has faded.

(6) Life time of light tower

The many steel lattice light towers constructed for the last twenty (20) years are needed to replace. Their lifetimes are assumed to be shorter than about 30 years. The maintenance services are very important for the light towers as well as lighting equipment and power supply.

Light tower made of reinforced concrete has an advantage of long lifetime, which is assumed to be more than 50 years under proper construction work and maintenance. Quality control required for concrete work is most important factor for lifetime. Approximately eight (8) months is required for the construction of lighthouse because work is influenced by weather condition and management of construction schedule is difficult.

Therefore, the light tower made of reinforced concrete is preferable for the lighthouse and light beacon to be constructed at the location where access is not easy and proper raw material such as sand, gravel is not easily obtained near the site.

Existing 40m high light towers made of reinforced concrete for lighthouse constructed at remote area by Japan's Loan took almost twelve (12) months for on site construction works. Current situation of tower is good in another five (5) years after completion of construction.

(7) Obstruction to light sector

The obstruction such as trees must be removed in a routine maintenance.

(8) Responsibility areas for operation and maintenance of District of Navigation Offices

There are some lights, which should be managed and maintained by an office other than proper District of Navigation Offices.

(9) Reinforcement of professional awareness on aids to navigation services

The technicians in charge for operation and maintenance for aids to navigation should have a professional awareness on aids to navigation services. It is the responsibility of the heads of offices and chief of staffs.

(10) Report

In connection with preparation of reports such as annual and monthly report concerning aids to navigation services, the mistyping and insufficient information in the reports will become confusing in the management of aids to navigation as well as clerical routine works.

(11) Close cooperation with organization concerned on aids to navigation

The visual aids to navigation to be put on some nautical charts in Indonesia published by the Hydrographic Office have not complied with current situation of the existing lights.

(12) Radio aids to navigation

Most of the medium wave radio beacon stations and radar beacon stations have stopped because of insufficient maintenance system and shortage of spare parts and so forth.

The problems above are mainly caused by the followings:

- Shortage of routine budget for operation and maintenance and management,
- Maintenance system without sufficient manual for operation and maintenance and management,
- Shortage of personnel with technical knowledge and skill required for the aids to navigation services and shortage of the leadership of the heads of offices and chiefs of staffs,
- Insufficient public relation activities on aids to navigation services,
- Insufficient communication among offices concerned.

6.1.2. Recommendation on Management and Maintenance

(1) Improvement of budgetary situation

The routine budget for operation, management and maintenance from general account has been extremely insufficient. The supplementary budget from light dues will improve the budgetary situation for operation and maintenance and management.

At first, however, it is necessary to make great efforts for the increase of routine budget. If the routine budget increase up to nearly requested routine budget, the supplementary budget from light dues should be more effectively allocated to the important budgetary field with priority on the operation and maintenance for aids to navigation services such as procurement of equipment, spare parts, fuel for vessels and so forth.

(2) Improvement of management and maintenance system

① Re-arrangement of responsibility area for operation and maintenance

It is recommended that the responsibility area for the operation and maintenance of District of Navigation Offices shall be re-arranged in consideration of the followings:

- To draw definite boundary lines among adjacent responsibility areas,
- To transfer management on aids to navigation facilities,
- To make economical arrangement in consideration of distance between lights and maintenance bases and allocation of existing visual aids to navigation.

② Improvement of clerical work and establishment of mailing system

It is recommended that personal computer (PC) and peripheral equipment should be reinforced at each office in order to reduce clerical errors and make speedy and reliable reporting services.

It is recommended to establish a mailing system through Internet as immediate method in order to make a close contact among offices concerned at a reasonable cost. It is expected that the close contact between DGSC and district offices can shorten a long time lag of notification on the lights to mariners.

It is recommended to establish database for inventory on PC in order to manage visual aids to navigation and supporting facilities.

The databases on PC have the following advantage:

- Reliable updated data subject to maintenance,
- Timely available updated data,
- Easy processing such as searching and sorting,
- Speedy preparation of reports and documentation,
- Property as well as person in charge available in common, and
- Upgrading skill of personnel utilizing PC, reinforcement of professional awareness.

③ Reinforcement of public relations activities and introducing light monitoring helper system

In connection with operation area where reliability of lights is low, there are many troubles of lights due to theft and ship’s hit and run.

Those are the first and the second causes respectively to reduce the availability/ reliability of lights. It is very difficult to cope with those causes. Any countermeasure to the lights is useless. It is not technical issues, but moral issues.

The following manners are recommended:

a. Reinforcement of public relations activities

It is recommended that DGSC and district offices make steady and continuous public relations activities on the maritime safety services including aids to navigation to the local communities.

It may be effective and suggestible manners that Japan Coast Guard makes public relations activities in order to explain purposes of aids to navigation and its importance through the followings:

- Distribution of pamphlets/leaflets,
- Cooperation with observation tours to aids to navigation facilities by children of elementary school and students of junior high school and so forth,
- Friendly relations with the peoples through events and festivals of local communities,
- Holding an exhibitions such as sailing demonstration and some events on the national holiday of “Maritime Day” and so forth
- Close contact with Fisherman’s Cooperative Association

b. Introducing light monitoring helper system

It is recommended that the light monitoring helper system would be introduced.

It may be suggestive manner that Japan Coast Guard has adopted the light monitoring helper system in which lights are monitored by an influential or noted person in the local community near the lights.

They are mostly voluntary services. The amount paid for a month per one (1) light is equivalent to nearly telecommunication fee only.

④ Maintenance of radio aids to navigation and VTS

It is desirable that the technicians of coastal radio stations, who are familiar with similar radio equipment, should maintain the radio aids to navigation and VTS.

(3) Reinforcement of bases for maintenance

① Workshops and buoy bases

For the workshops and buoy bases as maintenance bases for visual aids to navigation, it is required that the following equipment should be reinforced for maintenance of lighting equipment, buoys and so forth and related works for aids to navigation services:

- Machine tools (lathe, precision lathe, universal milling machine, etc.)
- Woodwork machine (wood milling machine, wood band saw, etc.)
- Compressor and pump (blower, water jet pump, mobile air compressor, etc.)
- Hand tools and bench tools
- Testing and measuring equipment (ultrasonic thickness tester, luminous intensity meter, GPS receiver, solar module tester, etc.)
- Electronic equipment (Oscilloscope, frequency counter, etc.)
- Handling equipment (Electronic hoist, overhead traveling crane, fork lift, mobile crane, harbor crane, truck, maintenance car, etc)
- Diesel engine generator set

It is recommended that the workshops and buoy bases should be located at the same place in order to utilize efficiently and effectively the equipment and tools for maintenance. The workshop and buoy base at DISNAV Banjarmasin should be located at the same place.

② Maritime Safety Technology Center (BTKP: Balai Teknologi Keselamatan Pelayaran)

Many kinds of material and parts are used for the equipment in the aids to navigation field.

For the BTKP that has a function of inspection of these materials and equipment, equipment such as impact testing machine, tensile strength tester, universal testing machine are required as well as ①above to inspect the performance of lighting equipment, mooring chain and other materials.

(4) Technology Transfer

The group training for management on aids to navigation services was carried out for last thirty (30) years by JICA.

It is desired to continue the group training at JICA to study the management on aids to navigation services, or to establish new training scheme for management on aids to navigation services.

6.2. Telecommunication System

6.2.1. Current Situation of Management and Maintenance

Site surveys for mainly 1st and 2nd class stations were made and questionnaires were sent to all 221 stations to study current situations of maritime telecommunication system.

(1) Site Survey

The results of site survey are shown in **Appendix 5.2.1.(Part Ⅰ) "Current Situation on Maritime Telecommunication System by Site survey"**, and the management and maintenance are outlined as follows;

① It was found that were many cases of aging and trouble of equipment and facilities,

② Spare parts/units, measuring instruments, vehicles and air conditioners are insufficient.

③ Some technicians are well trained, while others were insufficient knowledge and experiences.

④ Some stations are well managed and maintained, but others are not good.

(2) Questionnaires

The results of the survey by questionnaires are shown in separate volumes titled **"Maritime Telecommunication Facilities, Inventory, Plant Records and Outlokk-2001"**.

There are many demands from coast stations in the following matters;

① Increase of maintenance budget

② Sufficient provisions of spare parts and units

③ Replacement of aged equipment

④ Increase of training opportunities

⑤ Increase of technicians at coast stations

6.2.2. Problems relating to Management and Maintenance

(1) Shortage of budget for management and maintenance

The decrease of management and maintenance budget for years caused the following problems;

① Shortage of spare parts and units in many coast stations

② Out of order of air conditioners in transmitting and receiving stations

③ Lack of vehicles for maintenance patrol

④ Decrease of training opportunities

(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.

(4) Inactive maintenance system

Management and maintenance system have not functioned as a whole including above (1), (2) and (3) at present.

6.2.3. Recommendation for satisfactory Management and Maintenance

(1) Increase of budget for management and maintenance

Budget for management and maintenance has extremely decreased for years and it's become the biggest problem.

However, the budget from the Light Due has been allotted to DGSC from 2001.

Appendix 6.2.1 shows the maintenance budget of coast stations in past and at present.

The maintenance fee for maritime telecommunication system have substantially increased by the Light Due.

Accordingly, the maintenance condition will be greatly improved hereafter.

It is necessary to make efforts to get more budget and to make efficient use focusing important matters.

(2) Sufficient supply of maintenance equipment and facilities.

It is necessary to keep the following equipment and facilities properly and sufficiently;

① Spare parts and units

② Measuring and testing equipment, repairing tools

③ Vehicles for maintenance (van-type car and motorbike)

④ Air conditioners in transmitting and receiving stations

(3) Posting of proper supervisors at coast stations

The following persons should be those with sufficient knowledge, skill and good leadership to carry out operation and maintenance properly;

① Chief of coast station

② Senior technicians and senior operators of coast station

(4) Increase of training programs

Various training programs are recommended to promote 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) Reinforcement of Maintenance System
In consideration of sophisticated equipment, it is necessary to establish the following integrated maintenance system;

① Purpose
The purpose is to establish practical and effective maintenance system with fully prepared facilities, equipment, simulators, measuring equipment spare parts, etc and high-level technicians.

② Supervisor of the Function
NAVIGASI of DGSC

③ Place to be installed
Tg. Priok

④ Major tasks
a. Management of budget for Maintenance
b. Management of spare parts, measuring equipment, repairing tools
c. Management of inventory for facilities and equipment of all the stations
d. Repairing and guidance of technology and repairing
e. Management of trouble, repair and training record
f. Preparing of Maintenance manual
g. Other services concerning maintenance

⑤ Equipment to be provided
a. Various types of equipment (for 1st, 2nd, 3rd and 4th stations)
b. Various types of measuring instruments
c. Various types of repair tools and testing equipment
e. Simulators for GMDSS etc
f. Spare parts and units
g. Inventory of facilities and equipment of all the station
h. Personal Computers (PC)
i. Log of repair
j. Maintenance manual

⑥ PC Network

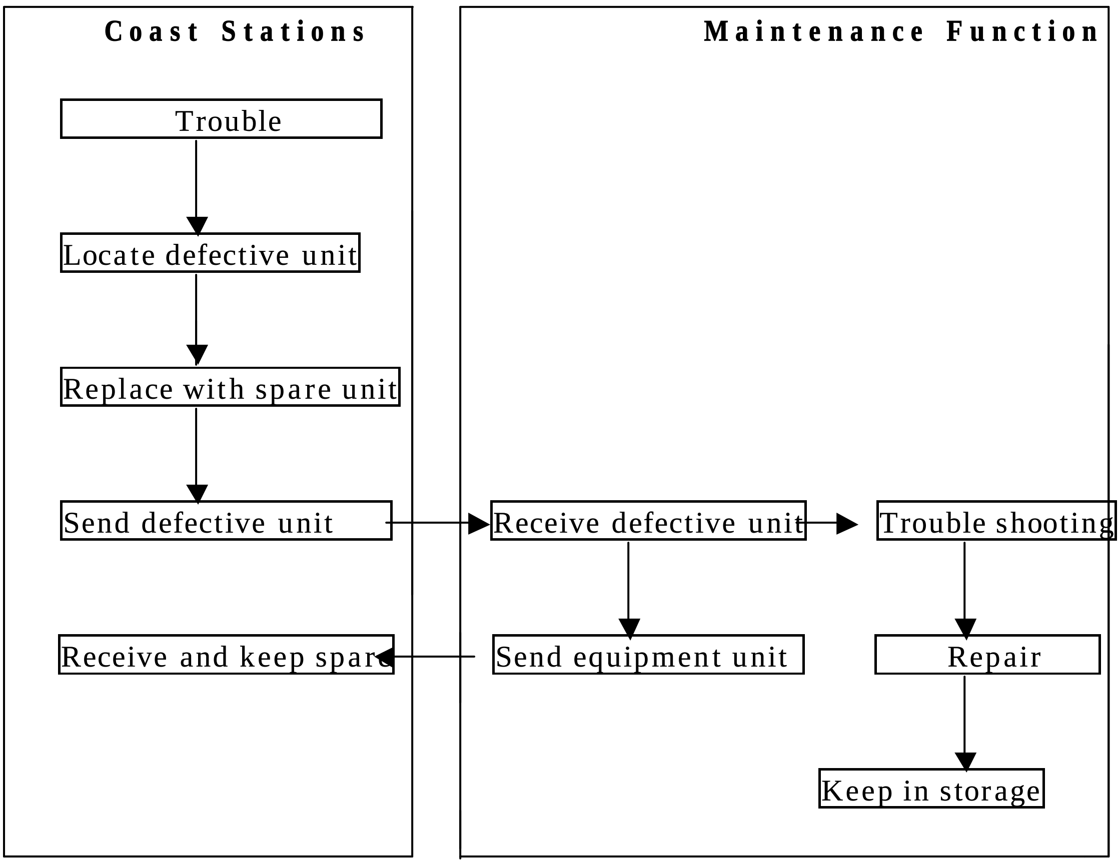
Form PC network between Function and 1st / 2nd stations, and utilize for;

a. Report from 1st / 2nd station on trouble and repair
b. Instruction from Function to 1st / 2nd station on repair
c. Guidance and counseling of inspection and repair
d. Inventory of facilities and equipment
e. Storage management of spare parts
f. Repair record
h. Trouble statistics
i. Maintenance personals
   - Certificates, training record, etc,
j. And any other maintenance matters.

⑦ Basic flow of maintenance

Basic flow for maintenance works is shown in **Figure 6.2.1.**

Figure 6.2.1. Basic Flow of Maintenance Works



CHAPTER 7.

RECOMMENDATION OF EDUCATION AND TRAINING

CHAPTER 7.
RECOMMENDATION OF EDUCATION AND TRAINING

7.1. 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.

At this moment, it can be said certain that new international tools such as the Ship Reporting System, DGPS, VTS and AIS will be introduced into this country in addition to the on-going GMDSS. Those who work for one of those kinds of new systems must be internationally oriented. Because they not only have to obtain knowledge and skills to maintain new equipment but also have to communicate with increasing number of foreign vessels.

In addition to the knowledge and skills on the new systems and basic knowledge of maritime affairs in support of them, they have to get considerable proficiency of standard marine navigational English.

Education and training should be of voluntary nature. The most important factor of education is to bring up a mind "do it myself." To pick up the mind and stimulate it is the very task of those who are engaged in education and training. In the long run, education and training should go systematically and organizationally to develop itself.

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.

7.2. General

7.2.1. Education and Training based on a Long term View

(1) International Trend

Recently there has been a remarkable progress in international society in the field of maritime traffic safety system such as GMDSS, Ship Reporting System, VTS, DGPS, AIS and MEH (Marine Electronic Highway). As one of big maritime nations, the Republic of Indonesia has introduced and will further take in such international new systems.

(2) Measures to be taken 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. The new technologies will certainly be much more sophisticated than traditional ones. They will have to be familiar with a wide variety of new information technologies such as computers, satellite communications and Internet as the basic knowledge for the new systems mentioned above.

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. The language in common to communicate with vessels of any flags is, of course, English. They have to speak and write English which is well understood by any mariners of any countries.

To meet any situations, they must have general idea of marine associated knowledge such as ships, navigation, maritime traffic, pilotage, marine accidents and search and rescue.

To carry out their job adequately, they have to know related international and domestic laws and regulations.

In addition to the above, the staff working for a specific facility must know all matters, which are special to the facility such as geography, sea and weather conditions and traffic density.

(3) 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. To write it is very easy but to realize it is quite a difficult task. Taking all possible efforts to pick up any signal of the mind and to stimulate and grow it up to the maximum is the very task of supervisors and those who are engaged in any kinds of education and training. Ideally, in the long run, education and training should go systematically and organizationally to develop itself.

7.2.2. 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, has not been given for years due to shortage of budget, etc. It should be resumed as early as possible.

② Overseas Group and Individual Training

The number of those who have participated 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 Travelling Experts at Local Facilities

Some technicians with rich experience at local facilities said this is the most effective type of training. If technicians at Headquarters can come with the experts, sometimes acting as interpreters, it will be more effective.

(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 as mentioned in **PART 1**; **9.4.1.** (4)① 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.

This subject will be further explained in general in **6.2.3.** because it is a very important and practicable type of training and there is much to write.

(3) Self-training

If someone knows the necessity of self-training and has an intention to do it, the training staff will be very easy to train him. The first step a training staff should take is to have trainees recognize the necessity and motivate them to do so. The success of every type of training will greatly depend on self-training.

7.2.3. On-the-Job Training (OJT)

(1) Influence of the Supervisor on the Development of the Staff

A person with a mind of self-training will grow through his efforts even outside of his job but most of the opportunities to grow him is in the place he works for, because he spends most of the time there every day.

Usually, his boss gives him a job and it will be achieved under the instruction and supervision of the boss.

One type of boss knows much about him and gives him a job in such a way as may draw out his ability to the maximum. The other type of boss pays little attention to his staff and takes hands-off policy.

It is sure that there will be a clear difference between the two in the development of the staff.

(2) Definition and Nature of OJT

① What is OJT?

OJT is the method of guiding and developing the staff by the supervisor through the conduct of job.

To say in detail, OJT can be defined as "a systematic, purposeful and continual educational activities by a supervisor through a job for the improvement and development of capabilities (knowledge, skill and attitude) of the staff necessary for carrying out the job."

What OJT intends for is the capability necessary for a job. The job is not only the present one but also a job expected to do in the near future.

A big difference from other kinds of capability development is "through a job." "Through a job" does not necessarily mean, "while carrying out a job," but includes cases where there are close relations with the job.

"Systematic" means that there is a target of capability development that OJT intends to achieve and a time limit as well. The target and schedule must be made clear.

"Purposeful" means that the emphasis is placed on the development of particularly important matters among capabilities necessary for the job, in consideration of efficiency.

"Continual" means that capability development must be done carefully and without haste because it cannot be achieved in a very short periods.

② Merits of OJT

a. OJT is easy to hold in terms of time, place and cost compared with other training such as group training that takes place outside the work place.

b. Education and training is the most effective when it is given in consideration of personality and nature of each individual. OJT is in principle carried out on individual basis and has this merit.

c. The supervisor has a powerful influence over his staff through the allotment of jobs and routine guidance of services. The supervisor's ways of thinking and methods of carrying out job are observed and learned by his staff. Whether they are conscious or not, OJT is carried out every day and every time. The influence of the supervisor on his staff is so strong that OJT must be done systematically and purposefully.

③ Basic Steps of OJT

Various methods can be taken for the implementation of OJT depending on the nature of job, ability of staff, allowable time, capability of instructors, available equipment, etc., but the basic steps to be taken will be as follows:

a. The 1st Step is to consider and decide what kind and quality of capability is required for the job. Concrete and detailed items must be figured out.

b. The 2nd Step is to think about aptitude, characteristics and interest of the person to be trained talking directly with him.

c. The 3rd Step is to set up the target of training in consideration of necessity studied at the 1st Step and the aptitude, etc. considered at the 2nd Step.

7.3. 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.

There have been many guidelines for the training of personnel, who are working for these kinds of facilities. They are in such forms as international conventions, regulations, resolutions and manuals.

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:

7.3.1. GMDSS

(1) Trainees

Trainees are operators and technicians of coastal radio stations.

(2) Period of Training

The 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 Theory

The trainees should learn theoretical knowledge at first about the outline of GMDSS, its sub-systems and related systems such as satellite system.

② Regulations and Documentation

The operator should have knowledge of GMDSS related international and domestic laws and regulations such as the SOLAS Convention and the Radio Regulations with particular emphasis on distress, urgency and safety radio communications.

③ Watch keeping and Procedures

Training should be given in communication procedures necessary for the efficient operation of GMDSS, especially on distress, urgency and safety.

④ Practical Training

Practical training, supported by appropriate laboratory work, should be given in operation of GMDSS and maintenance of sub systems.

⑤ Practical English

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.

Note: Contents of Training above were picked up from "TRAINING OF RADIO PERSONNEL IN THE GLOBAL MARITIME DISTRESS AND SAFETY SYSTEM (GMDSS)", IMO Resolution A.703 ()17) adopted on 6 November 1991 (Agenda item 10) and arranged for those who are to work for coastal radio stations equipped with GMDSS.

7.3.2. 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.

However, it is sure that operators who are working for some of coastal radio stations (maybe 1st and 2nd class) will take duties of the system.

As for maintenance, not much will be required for technicians who are familiar with GMDSS equipment. Some additional knowledge and skill will be necessary about computers and display systems.

(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 that has comparatively long experience. This kind of training must be given to senior operators so that they may give on-the-job training to junior operators after they come back to Indonesia. The training will be held in well advance of the start of operation. One-month period will be necessary.

② Training by experts who have rich experience of operating the system. This training must be given at coastal radio stations that operate the system. One-month period for each station before and after the start of operation will be necessary.

(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.

Normally the ship reporting system is of passive nature compared with the vessel traffic service (VTS), which is of positive nature. Those who have been trained for GMDSS operators (ship reporting system operators will be operators of coastal radio stations at the same time) are basically fit for the operation. So additional practical training mentioned above (3) will be sufficient. Probably some factors will be taken from VTS operators' training to be explained in 6.4.3. depending on the circumstances.

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.

Note: Refer to "GENERAL PRINCIPLES FOR SHIP REPORTING SYSTEMS AND SHIP REPORTING REQUIREMENTS, INCLUDING GUIDELINES FOR REPORTING INCIDENTS INVOLVING DANGEROUS GOODS, HARMFUL SUBSTANCES AND/OR MARINE POLLUTANTS": IMO Resolution A.851(20) Adopted on 27 November 1997 (Agenda item9)

7.3.3. 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.

Sometimes decision-making must be done immediately without time of consulting with senior officers. VTS is usually operated round-the-clock, so the supervisor of each team should be a good decision-maker.

Each operator also must have a sense of making right judgement for every situation, especially about what to report to the supervisor.

As for technicians, they must be capable of maintaining new type equipment such as multi-functioned radars and computers.

(1) Trainees

Operation group should be divided into several skilled personnel depending on the level of responsibility. It is desirable that supervisors and operators will be among personnel coming from Merchant Marine graduate or those 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 supporting for 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 training and practical training should be given at VTS facilities abroad, which have long experience of similar operation. The trainees will preferably those who have rich experience in operation of ships and/or facilities similar to VTS. 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 OJT style practical training.

This training should take place well in advance of the completion of the facilities.

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. This training should be given before and after the start of operation. The period will depend.

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. Excellent 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 and allied services.

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)②, training will be given by the supervisors on the job basis, so the contents of training will follow suit.

*Note: **7.3.3.** was written referring mainly to GUIDELINES FOR VESSEL TRAFFIC SERVICES; IMO Resolution A. 857(20) adopted on 27 November 1997 (Agenda item 9), and Recommendation on Standards for Training and Certification of VTS Personnel; IALA Recommendation V-103 May 1998*

7.3.4. 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 bad 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;

New technologies necessary for the system, and maintenance and operation.

③Domestic 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.

7.4. Establishment of Integrated Education and Training System

7.4.1. Organization and Training Staff

In order to make education and training effective, it must be well organized and implemented systematically in accordance with determined targets and schedule. It should last long time to bring up those with aptitude in a wide variety of fields as many as possible.

Ideally once the education and training system is firmly established, it will walk and make its way on its own foot, namely without any assistance especially from foreign countries. There will be many difficulties on the way such as budget and staff. These difficulties must be got over as early as possible.

(1) Education and Training Management Staff

It goes without saying that the roles of education and training management staffs (hereafter referred to as "training staff") are very important. Basic roles of training staffs are as follows:

① to be in charge of a series of services, as the experts of training, to promote efficient development of persons, such as;

- preparing training system,
- determining responsibilities of managers and supervisors to train their men,
- establishment of training organization,
- establishment of systems and regulations concerning training,
- planning of budget and allotment,
- drafting of long-term education and training,
- assessment and follow-up of training plans of each sector.

② to find out training needs and give direction to the training in the organization and give them priority in consideration of the importance, urgency, relativity, etc.

③ to give suggestions and assistance to their supervisors, as the training experts.

④ to prepare and implement various training courses.

⑤ to enlighten all the organization on the necessity of ability development and to motivate each person to train himself.

(2) Follow-up of Training

Education and training should be followed up to improve the system for the future. Contents and results of training must be recorded and evaluated in detail for each training course and for each trainee.

(3) Incentive or Motivation

① Training and Promotion

② Training, Certification and Promotion

③ Qualification for some Jobs such as GMDSS/VTS Supervisors and Operators

7.4.2. Staying Experts for the Establishment of Education and Training System

To educate training staff and establish integrated education and training system, it is suggested that some experts having rich experience in the field will be invited to this country and stay for a period long enough (a year or two) to achieve the purpose.

There have been a lot of unknown factors in the field, so at first they have to make study about the needs, analyze them and then recommend to establish systematic training system in terms of organization and training staff.

The counterparts during the study will be the future training staffs.

7.4.3. Study of Education and Training System of Foreign Countries

Before the above study, those who are to be future training staffs should visit to a foreign country where education and training systems in maritime safety fields are well organized and implemented. This will not take long; probably one month will be sufficient.

7.4.4. Integrated Education and Training for Maritime Safety

As mentioned in **Part 1, 9.4.3.** and **9.4.4**., the Education and Training Agency 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 at present, however, are mostly for the education and training of seafarers.

According to the report of a JICA expert dispatched to the Center, it is planning for the future to expand its services to various fields related to marine affairs; such as education of government officers, educators and researchers. In addition, it will also play a role of making research on a wide variety of maritime affairs.

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.

7.5. Summary of Recommendation on Education and Training

7.5.1. General

(1) Establishment of Integrated Education and Training System
(Refer to **7.4.**)

a. Organization and Training Staff
b. Staying Experts to help establish the System
c. Study by Training Staff in Foreign Countries
d. Establishment of education and training system for 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.
(Refer to **PART 1; 9.4.1.** (4)②)

(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.
(Refer to **7.2.3**., **PART 1; 9.4.1** (4), **7.3.2.**(3)①, **7.3.3.**(3)②)

(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.
(Refer to **7.3.1.** (3), **7.3.3.** (3)④)

(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 job.
(**7.3.1.** (3)④, **7.3.2.** (3)②)

(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.

7.5.2. 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 be prepared for such international trends.

(1) Proficiency of English Language.
Operators under new systems must have the 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.
(Refer to **7.1.** 4th paragraph, **7.2.1.** (2)②, **7.3.1.** (4)②⑤, **7.3.2.**(4)②, **7.3.3.**(4) ①G and ②)

(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.
(Refer to **7.2.1.** (2)②, **7.3.1.** (4)②, **7.3.3.** (4)②)

(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.

7.5.3. 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. (Refer to **7.3.2.**)

(2) VTS

a. Training abroad for Supervisors
The number of trainees will depend on the details to be developed.
The period will be about four weeks.

b. Training for Other Staff
In principle, the supervisors above will give training on OJT basis at each VTS stations.

c. Training by Experts from abroad
If the above training is not enough, experts from abroad will give training at the sites.

d. Simulation Training

Simulation training is especially necessary for VTS operators.

(Refer to **7.3.3.** (3)①②③, (4)②)

(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.

(Refer to **7.3.4.**)

7.5.4. 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

Other than manuals given by manufacturers at the completion of facilities and/or installment of equipment, 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.

The study team has found such manuals in the facilities neither of aids to navigation nor of coastal radio stations.

(Refer to **7.2.1.** (2)②)

(3) Group Training for New Systems

In consideration of the new trend, it is suggested that a 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 8.

RECOMMENDATION OF THE MATTERS RELATED TO MARITIME TRAFFIC SAFETY SYSTEM

CHAPTER 8.
RECOMMENDATION OF THE MATTERS RELATED TO MARITIME TRAFFIC SAFETY SYSTEM

8.1. Introduction

During this 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 questionable whether or not they are properly operated as initially designed.

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 KPLP's "PANAH-201" are almost half of the initial designed speed due to historically 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 reference, the passenger ship sank on May 27, 2001 and there were 49 missing and 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 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 marine casualty prepared by DGSC and historically no activities to confirm the marine traffic density through a site survey in the Sea Lanes as mentioned in the **Main Report Part 1**.

Considering above insufficient condition about both fields of hardware and software, it came 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.

8.2. Proposed Traffic Separation Scheme (TSS) in Sunda Strait

8.2.1. Purpose

Ship's routing system aims to reduce the risk of marine casualties. It includes traffic separation schemes (TSS), two-way routes, recommended tracks, areas to be avoided, inshore traffic zones, roundabouts, precautionary area and deep water routes.

This simulation study utilizing the real time ship handling simulator was implemented to examine the effectiveness of initial plans, such as establishing of appropriate ship's routing system, of the Maritime Traffic Safety System in the target year of 2007 and 2020.

In this section, TSS is supposed as initial plan and examined. The other methods are also examined if necessary.

The Results obtained from this study are reflected to revision of initial plan and the most realistic ship's routing system in the area shall be established.

8.2.2. 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. Conception of the real time ship handling simulator is shown in **Figure 8.2.1**. Contribution of ship handling simulator is shown in **Figure 8.2.2**.

Figure 8.2.1. Abstract Conception of the Real Time Ship Handling Simulator

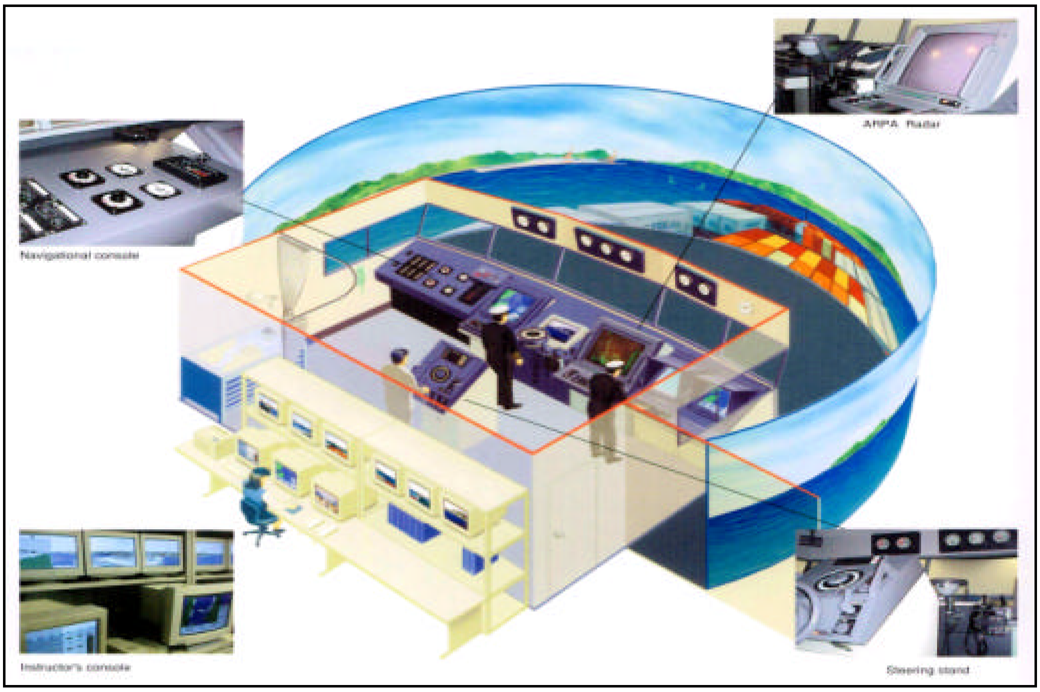
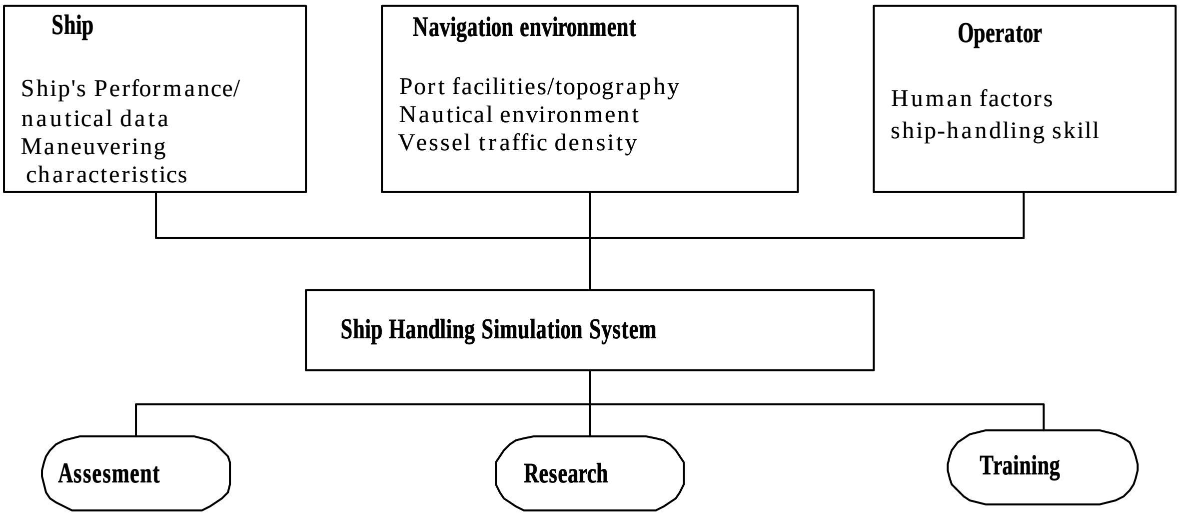


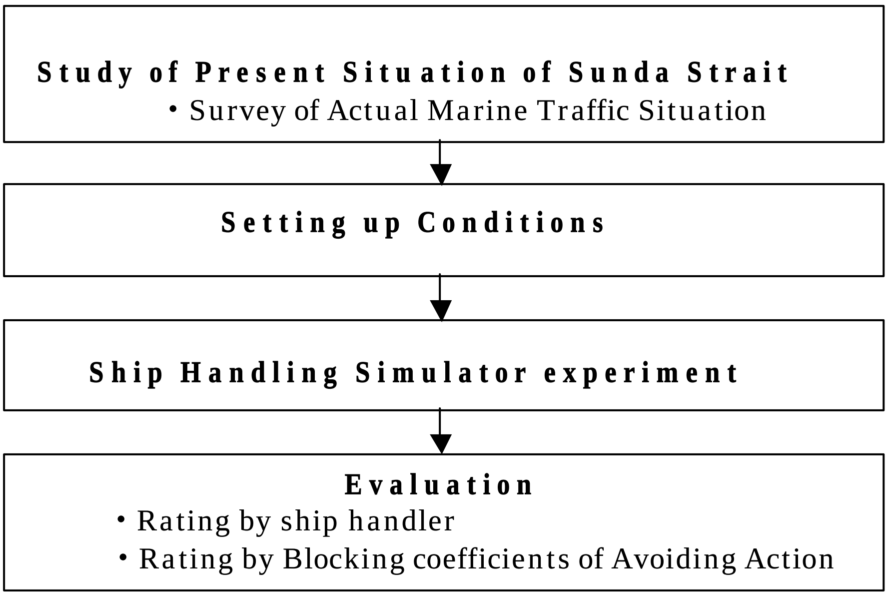
Figure 8.2.2. Contribution of Ship Handling Simulator



8.2.3. The Flow of Study

The flow of the study is shown in **Figure 8.2.3.**

Figure 8.2.3. The Flow of the Study



8.2.4. Survey Report of Actual Marine Traffic Situation

(1) Purpose of Survey

The purpose of survey is to grasp the actual situation of marine traffic in Sunda Strait, Indonesia, as basic data, and upon which to draw up a plan to improve safe navigation of the strait.

(2) Period of Survey

Continuous visual observation for 46 hours from 1500 hours on Oct. 18th to 1300 hours on Oct. 20th .

(3) Result of the Survey

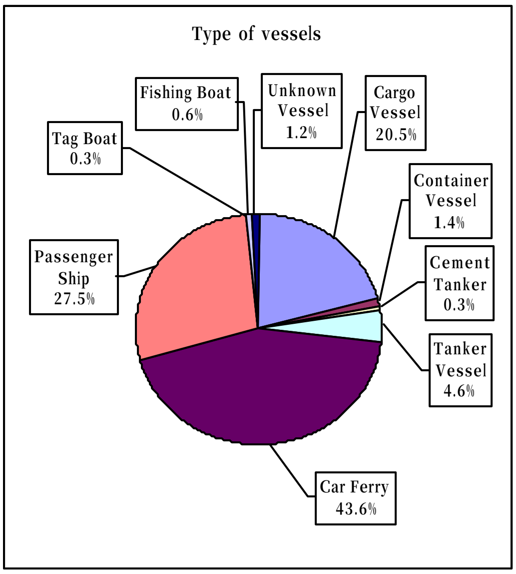
Total number of vessels observed was 346 during 3 days.

The major category among the ship's type is "Car Ferry types" with 151 vessels, accounting for 43.6%.

Table 8.2.1. Number of Vessels by Type and Size (All Days)

Unit: Number of vessels

	Cargo Vessel	Container Vessel	Cement Tanker	Tanker Vessel	Car Ferry	Passenger Ship	Tag Boat	Fishing Boat	Unknown Vessel	Total
0〜5GRT										0
5〜20GRT								1		1
20〜100GRT	5									5
100〜300GRT	12					93	1	1		107
300〜500GRT	5									5
500〜1,000GRT	5			2						7
1,000〜3,000GRT	12	1	1	2	29				3	48
3,000〜6,000GRT	11	1		5	120	1			1	139
6,000〜10,000GRT	2	2			2					6
10,000〜20,000GRT	6			2		1				9
20,000〜50,000GRT	9	1		4						14
50,000GRT〜	4			1						5
Unknown										0
Total	71	5	1	16	151	95	1	2	4	346



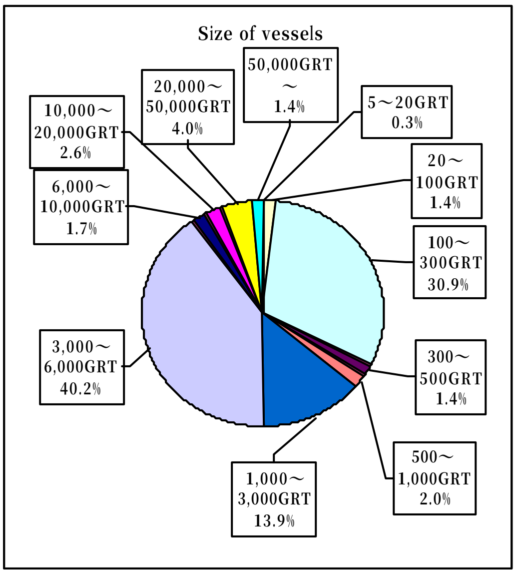
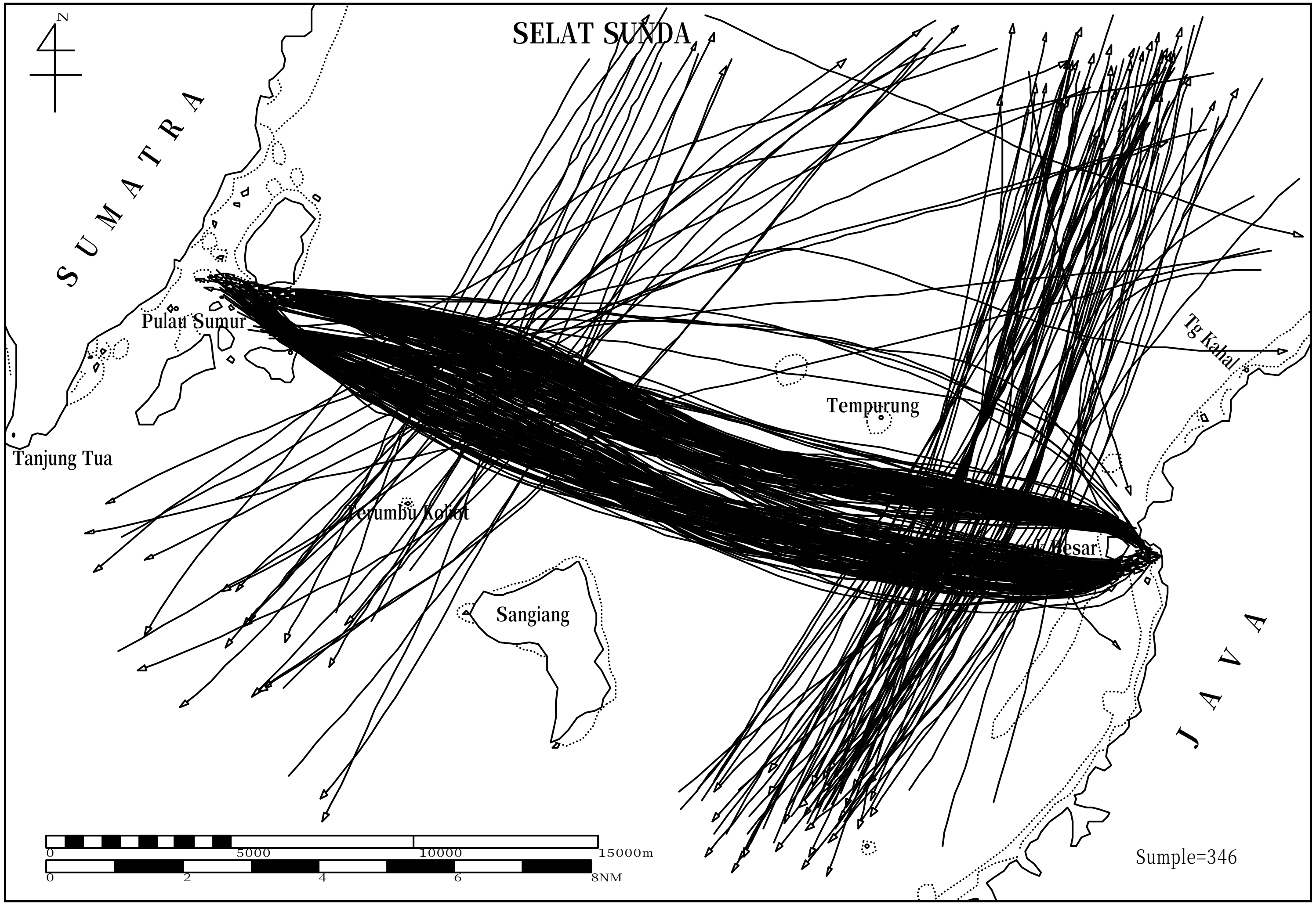


Figure 8.2.4. Track Chart (All Vessels) (3Days)



8.2.5. Setting up Conditions

(1) Simulation Area

The simulation area shall be set up in Sunda Strait shown in **Figure 8.2.5.** The simulation study was implemented on east and west sides of Sangiang Island.

Figure 8.2.5. Simulation Area

(2) Model Vessel

The model vessel, which is supposed to be the largest in this area, shall be VLCC of 280,000DWT class. Principal particulars of the model vessel are shown in **Table 8.2.2.**

Table 8.2.2. Principal Particulars of Model Vessel

Item	280,000 DWT
LOA (m)	330.0
Lpp. (m)	316.6
Breath (m)	60.0
Draft (m)	Southbound: 10.5 Northbound: 20.5

(3) Traffic Condition

The Traffic condition at the area of this Study is based on situations at present, in 2007 and 2020.

The present Traffic condition refers the Maximum Passing Vessels Volume from the Survey of Actual Maritime Traffic in Oct. 2001.

Moreover, the traffic volumes in 2007 and 2020 were obtained as 1.6 times in 2007 and 3.7 times in 2020 comparing to the present volume referred to the Future Interisland and International Calling Vessels Volume of the Final Report.

(4) Natural Conditions

Natural condition is shown in **Table 8.2.3.**

Table 8.2.3. Natural Conditions

Items	Conditions
Wind direction/velocity	ESE 5meter/second
Tide	South 1.25 Knots/hour
Visibility	10 miles
Day/Night	Daytime

(5) Simulation Scenario – Condition Matrices of Ship Handling Simulator

For implementing the ship-handling simulation, the study team discussed simulation scenarios with senior captains.

Based on this discussion, we divided the scenario into two stages which means Stage-1 is traffic condition in 2001 without the premises of TSS and Stage-2 is traffic condition in 2007 and 2020 without/with the premises of TSS.

The simulation scenario consists of 20 cases that are combinations of the traffic condition of North/Southbound.

The outline of the simulation scenario is shown in **Table 8.2.4** and the details of simulation scenario are shown in **Table 8.2.6.**

Table 8.2.4. The Outline of Simulation Scenario

Stage	Traffic Condition	TSS	Routes		Test Cases
			Eastside Channel of Sangiang Island	Westside Channel of Sangiang Island	
Stage- 1	Present Condition	—	North / South bound	North / South bound	4 cases
Stage- 2	2007	—	North / South bound	North / South bound	4 cases
Stage- 2	2020	N/A	North / South bound	North / South bound	4 cases
Stage- 2	2007	Case I	North / South bound	—	2 cases
Stage- 2	2020	Case I	North / South bound	—	2 cases
Stage- 2	2007	Case II	North bound	South bound	2 cases
Stage- 2	2020	Case II	North bound	South bound	2 cases
Total					20 cases

TSS is established for the simulation study in accordance with **Table 8.2.5.**

Table 8.2.5. Establishment of TSS

Case	Establishment of TSS
Case I	Southbound and Northbound TSS in Eastside channel of Sangiang Island
Case II	Northbound TSS in Eastside channel of Sangiang Island, Southbound TSS in Westside channel of Sangiang Island

Establishment of TSS (Case I and Case II) are shown in **Figure 8.2.6.** and **Figure 8.2.7.** respectively .

Figure 8.2.6. Establishment of TSS (Case Ⅰ)

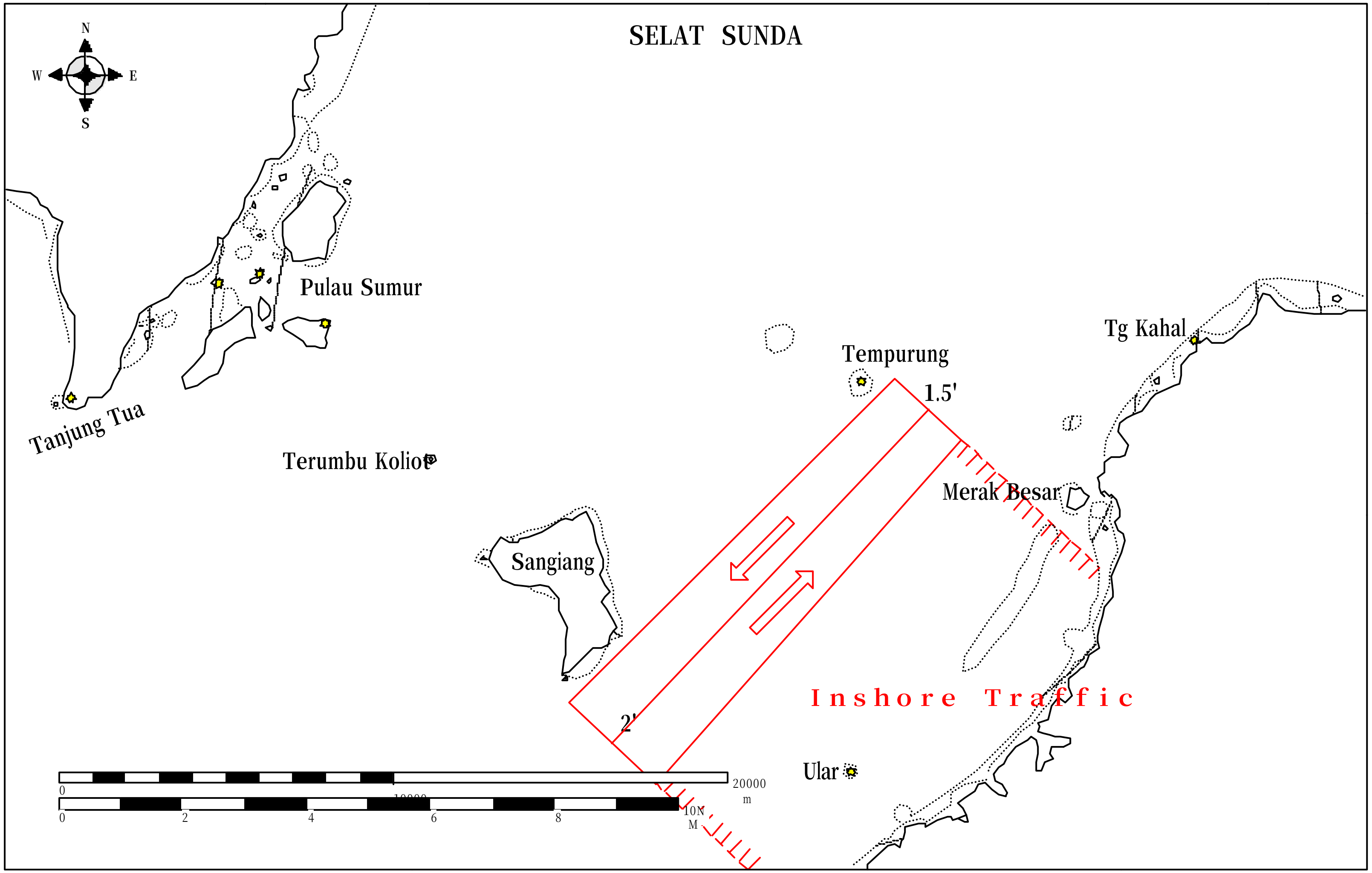


Figure 8.2.7. Establishment of TSS (Case Ⅱ)

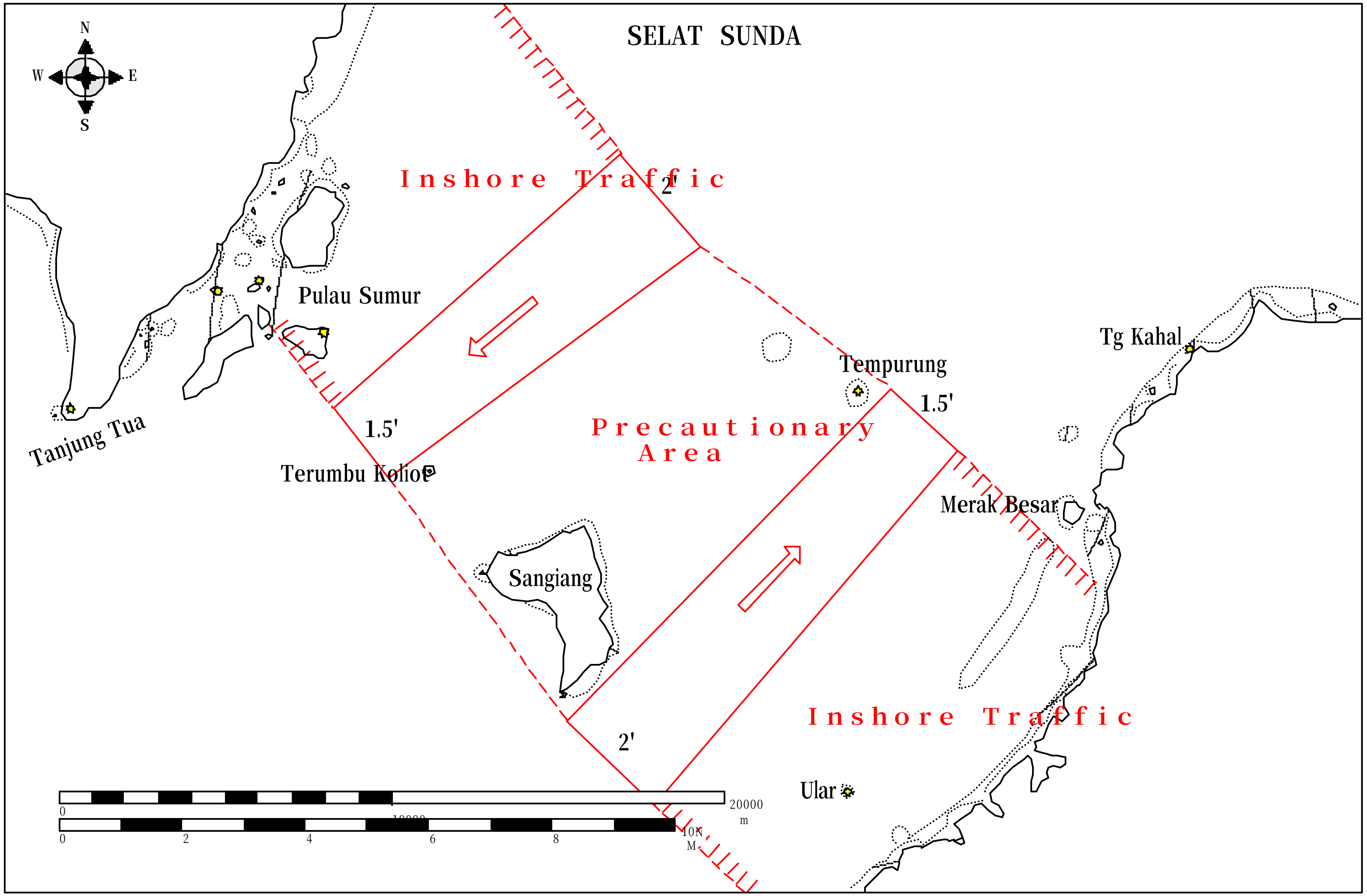


Table 8.2.6. The Details of Simulation Scenario

Code	Year	Draft	Channel	Bound	Tidal Current	Wind	TSS
01	2001	20.5m	East	North	South 1.25 knots	ESE 5m/sec	Nil
02	2001	10.5m	East	South	South 1.25 knots	ESE 5m/sec	Nil
03	2001	20.5m	West	North	South 1.25 knots	ESE 5m/sec	Nil
04	2001	10.5m	West	South	South 1.25 knots	ESE 5m/sec	Nil
05	2007	20.5m	East	North	South 1.25 knots	ESE 5m/sec	Nil
06	2007	10.5m	East	South	South 1.25 knots	ESE 5m/sec	Nil
07	2007	20.5m	West	North	South 1.25 knots	ESE 5m/sec	Nil
08	2007	10.5m	West	South	South 1.25 knots	ESE 5m/sec	Nil
09	2007	20.5m	East	North	South 1.25 knots	ESE 5m/sec	Case I
10	2007	10.5m	East	South	South 1.25 knots	ESE 5m/sec	Case I
11	2007	20.5m	East	North	South 1.25 knots	ESE 5m/sec	Case II
12	2007	10.5m	West	South	South 1.25 knots	ESE 5m/sec	Case II
13	2020	20.5m	East	North	South 1.25 knots	ESE 5m/sec	Nil
14	2020	10.5m	East	South	South 1.25 knots	ESE 5m/sec	Nil
15	2020	20.5m	West	North	South 1.25 knots	ESE 5m/sec	Nil
16	2020	10.5m	West	South	South 1.25 knots	ESE 5m/sec	Nil
17	2020	20.5m	East	North	South 1.25 knots	ESE 5m/sec	Case I
18	2020	10.5m	East	South	South 1.25 knots	ESE 5m/sec	Case I
19	2020	20.5m	East	North	South 1.25 knots	ESE 5m/sec	Case II
20	2020	10.5m	West	South	South 1.25 knots	ESE 5m/sec	Case II

8.2.6. Rating by Ship Handler

Rating by the ship handler participated in this simulation who is to be experienced captain shall be done. Rating by the observation of the other participants who are experienced captains also shall be done through questionnaire.

8.2.7. Rating by Blocking Coefficients of Avoiding Action

Blocking coefficients is a numerical factor that expresses the level of restriction (blocking) of collision-avoiding action (combination of alterations of course and speed = 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 shall be 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.

By these ways, 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.

8.2.8. Record of Ship Handling Simulation Study

Ship trajectories are to be recorded as time series for each run. Trajectories of maneuver and time histories of maneuver are shown in **Appendix 8.2**.

Views from Sangiang Island are shown in **Figure 8.2.8** and **Figure 8.2.9**.

Figure 8.2.8. View from South of Sangiang Island (1)

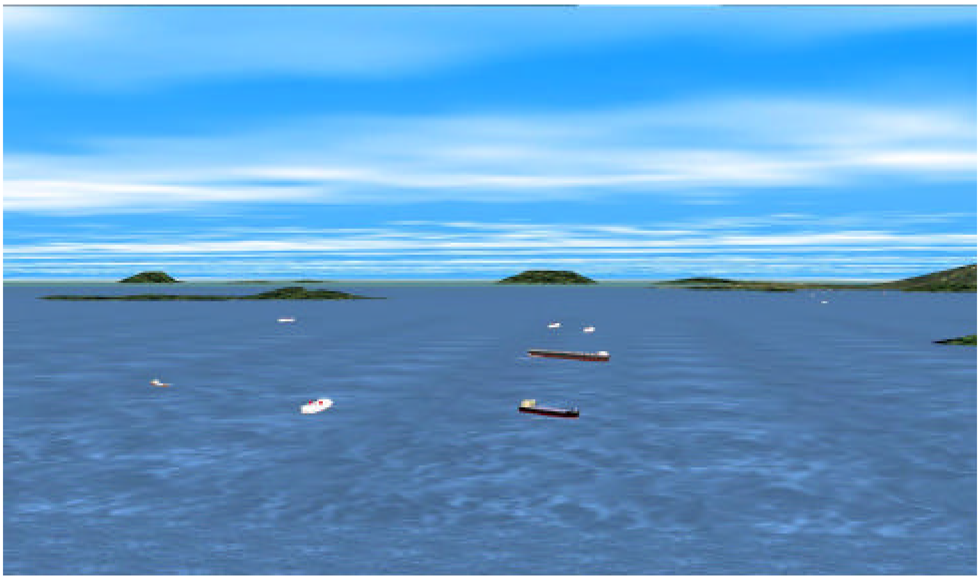
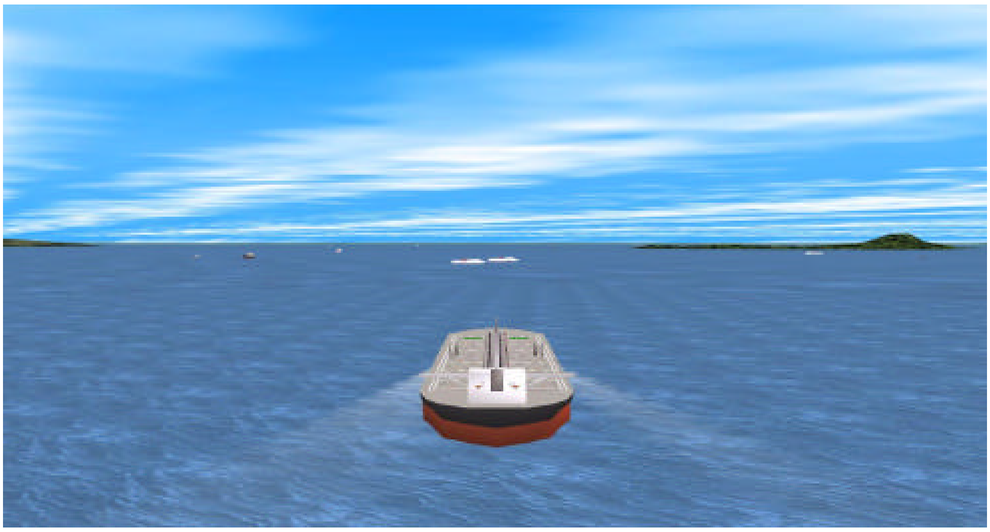


Figure 8.2.9. View from South of Sangiang Island (2)



8.2.9. Rating by Ship's Handlers (Stage-1)

Rating by the participated in this simulation that is to be experienced captain and by the observation of the other participants who are experienced captains is done through questionnaire. The questionnaire is shown in **Figure 8.2.10.**

Figure 8.2.10. Questionnaire for Sea Captains Possessing International 1st Class Master's License (Stage-1)

Questionnaire

Name Capt. Company

Please fill up your opinion I accordance with the undermentioned query.

1. How do you think if we plan to pass for the VLCC (280,000 D/W) at the SELAT SUNDA without economical matters.

   a. no riskb. evenc. low risk d. high risk

2. Do you feel what kind of risk ?

   a. collision b. aground c. other ____________________

3. Do you have any Idea in order to decrease the above risks.

   a. TSS b. VTIS c. Daylight Passing d. other ______

4. If we plan to set the TSS, where is the best location ?

   a. both side of SANGIANG island

   b. Between SANGIAN island and west coast of JAWA

   c. Both side of TERUMBU KOLIOT

5. If you mind many fishing boats at South of the SANGIANG island, how do you feel for passing at 4. (b) with safety ?_

The summary of questionnaires

Query 1. How do you think if we plan to pass for the VLCC (280,000 D/W) at the SELAT SUNDA without economical matters.

Answer 1.

No risk	Even	low risk	high risk
0	3	6	1

Query 2. Do you feel what kind of risk ?

Answer 2.

Collision	Aground	other
9	5	0

Query 3. Do you have any Idea in order to decrease the above risks.

Answer 3.

TSS	VTIS	Daylight Passing	other
9	0	2	1

Query 4. If we plan to set the TSS, where is the best location?

Answer 4.

Both side of SANGIANG island	Between SANGIAN island and west coast of JAWA	Both side of TERUMBU KOLIOT
9	0	1

Query 5. If you mind many fishing boats at South of the SANGIANG island, How do you feel for passing at 4. (b) with safety ?

Answer 5

- Difficult 2
- If meeting situation occurs and many fishing boats at this area, serious risk (collision and grounding) shall appear.
- Especially for northbound vessels, increase risk of grounding due to avoid fishing boats. Recommend TSS at both sides of Sangiang islands.
- Passing with care. In case of squall and night time, S/B eng. and increase look out shall be considered.
- If fishing boats stop or move slowly, feel not so danger.
- I will change her co. to pass west side of Sangiang

Island when northbound.

- Changing Route. Particularly night time, in case of enough water, carefully proceed with slow speed.
- Reduce speed and proceed with care.
- For VLCC, it may be sometimes dangerous.

8.2.10. Rating by Blocking Coefficients of Avoiding Action (Stage -1)

(1) East channel northbound (Code 01)

Rating by blocking coefficients is shown in **Figure 8.2.13.**

(2) East channel southbound (Code 02)

Rating by blocking coefficients is shown in **Figure8.2.14.**

(3) West channel northbound (Code 03)

Rating by blocking coefficients is shown in **Figure 8.2.15.**

(4) West channel southbound (Code 04)

Rating by blocking coefficients is shown in **Figure8.2.16.**

8.2.11. Discussion (Stage-1)

(1) Rating by captains

If VLCC (280,000DWT) will pass this strait, the summary of captain's opinions are as follows.

① Regarding risk, they think there is low or even risk of collision or aground. In order to decrease such risks, they think TSS or daylight passing is necessary.

② For the location of TSS to be settled, almost opinions are at the both side of SANGIANG island except one opinion at the both side of TERUMBU KOLIOT.

③ Regarding their opinions on presence of many fishing boats between SANGIANG island and west coast of JAWA when they pass this area, many captains feel danger and necessity to take proper countermeasures such as reducing speed, increasing lookout capability and changing course to west channel, especially in night time or squall.

(2) Rating by blocking coefficients of avoiding action

Regarding rating by blocking coefficients of avoiding action, the results show max of 0.2 except in case of east channel southbound. It means almost no problem. But in the case of east channel southbound, it shows max of 0.5. This figure is relatively high. In general speaking, if this figure exceeds 0.6, a captain on the bridge will meet a burdensome situation. This situation had happened at the crossing situation against crossing ferry boat. Figure 0.5 means that avoiding action limit to 50%.

(3) Overall rating

So far as the results of this real time simulation, there are not so major problem. However the special attention should be paid in the case of crossing situation with ferry boat, especially night time and restricted visibility.

8.2.12. Rating by ship's handler (Stage-2)

Rating by ship's handler (Stage-2) is made through questionnaire. The questionnaire is shown in **Figure 8.2.11.**

Figure 8.2.11. Questionnaire for Sea Captains Possessing International 1st Class Master's License (Stage-2)

Questionnaire

Name Capt. ______________________ Company ____________

Please fill up your opinion in accordance with the undermentioned query.

1. How do you think if we plan to pass for the VLCC (280,000 D/W) at the Strait SUNDA without economical matters?

   a. no risk b. even c. low risk d. high risk

2. Do you feel what kind of risk?

   a. collision b. aground c. other ____________

3. Do you have any idea in order to decrease the above risk?

   a. TSS b. VTIS c. Daylight Passing d. other ______

4. If we plan to set the TSS, where is the best location? (Without TSS)

   a. both side of the SANGIANG island

   b. between the SANGIANG island and the JAVA island

   c. both side of the TERUMBKU KOLIOT

5. If you mind many fishing boats at South of the SANGIANG Island, how do you feel for passing at 4.(b) With safety?

6. How do you think about this location of TSS? (With TSS)

Your comment for safe passage, if any.

The captains' answers are summarized in **Table 8.2.7**, **Table 8.2.8**, **Table 8.2.9**, **Table 8.2.10**, **Table 8.2.11**, **Table 8.2.12** and **Table 8.1.13.**

Table 8.2.7. Captain Answers to Question 1

Question 1. How do you think if we plan to pass for the VLCC (280,000D/W) at the SELAT SUNDA without economical matters.					
	Code No.	Answer			
		a. no risk	b. even	c. low risk	d. high risk
Present	1	0	3	6	1
	2				
	3				
	4				
2007	5	1	4	4	0
	6	2	5	2	0
	7	2	5	2	0
	8	0	3	6	0
	9	0	3	5	1
	10	0	3	4	1
	11	0	5	2	1
	12	0	5	2	1
Sub Total		5	33	27	4
2020	13	0	2	2	3
	14	0	2	2	3
	15	0	3	5	0
	16	0	3	5	0
	17	0	2	3	2
	18	0	3	4	1
	19	1	4	3	0
	20	1	7	0	0
Sub Total		2	26	24	9
Grand Total		7	62	57	14
		Note: The number in the table shows how many captains were favorable to the Question.			

Table 8.2.8. Captain Answers to Question 2

Question 2. Do you feel what kind of risk?				
	Code No.	Answer		
		a. collision	b. aground	c. other
Present	1	9	5	0
	2			
	3			
	4			
2007	5	7	1	1
	6	6	1	1
	7	6	3	1
	8	9	4	0
	9	7	4	0
	10	7	2	1
	11	7	3	0
	12	7	1	0
Sub Total		56	19	4
2020	13	6	4	0
	14	7	2	0
	15	7	4	0
	16	7	4	0
	17	7	5	0
	18	8	2	0
	19	8	4	0
	20	6	2	1
Sub Total		56	27	1
Grand Total		121	51	5

Note: The number in the table shows how many captains were favorable to the Question.

Table 8.2.9. Captain Answers to Question 3

<table>
<tr><td colspan="6">Question 3. Do you have any idea in order to decrease the above risk?</td></tr>
<tr><td rowspan="2"></td><td rowspan="2">Code No.</td><td colspan="4">Answer</td></tr>
<tr><td>a. TSS</td><td>b. VTIS</td><td>c. Daylight Passing</td><td>d. other</td></tr>
<tr><td rowspan="4">Present</td><td>1</td><td rowspan="4">9</td><td rowspan="4">0</td><td rowspan="4">2</td><td rowspan="4">1</td></tr>
<tr><td>2</td></tr>
<tr><td>3</td></tr>
<tr><td>4</td></tr>
<tr><td rowspan="8">2007</td><td>5</td><td>6</td><td>1</td><td>1</td><td>0</td></tr>
<tr><td>6</td><td>5</td><td>1</td><td>1</td><td>0</td></tr>
<tr><td>7</td><td>6</td><td>1</td><td>1</td><td>0</td></tr>
<tr><td>8</td><td>8</td><td>1</td><td>1</td><td>0</td></tr>
<tr><td>9</td><td>4</td><td>4</td><td>2</td><td>0</td></tr>
<tr><td>10</td><td>4</td><td>3</td><td>1</td><td>0</td></tr>
<tr><td>11</td><td>5</td><td>3</td><td>0</td><td>0</td></tr>
<tr><td>12</td><td>6</td><td>3</td><td>0</td><td>0</td></tr>
<tr><td colspan="2">Sub Total</td><td>44</td><td>17</td><td>7</td><td>0</td></tr>
<tr><td rowspan="8">2020</td><td>13</td><td>6</td><td>1</td><td>1</td><td>0</td></tr>
<tr><td>14</td><td>7</td><td>1</td><td>2</td><td>0</td></tr>
<tr><td>15</td><td>7</td><td>0</td><td>2</td><td>0</td></tr>
<tr><td>16</td><td>7</td><td>0</td><td>2</td><td>0</td></tr>
<tr><td>17</td><td>5</td><td>3</td><td>2</td><td>0</td></tr>
<tr><td>18</td><td>6</td><td>3</td><td>1</td><td>1</td></tr>
<tr><td>19</td><td>7</td><td>3</td><td>0</td><td>0</td></tr>
<tr><td>20</td><td>4</td><td>3</td><td>0</td><td>0</td></tr>
<tr><td colspan="2">Sub Total</td><td>49</td><td>14</td><td>10</td><td>1</td></tr>
<tr><td colspan="2">Grand Total</td><td>102</td><td>31</td><td>19</td><td>2</td></tr>
<tr><td colspan="2"></td><td colspan="4">Note: The number in the table shows how many captains were favorable to the Question.</td></tr>
</table>

Table 8.2.10. Captain Answers to Question 4

Question 4. If we plan to set the TSS, where is the best location?				
	Code No.	Answer		
		a. both side of the P.SANGIANG island (TSS-Case Ⅱ)	b. between the P.SANGIANG island and the JAWA island (TSS-Case Ⅰ)	c. both side of the TERUMBKU KOLIOT
Present	1	9	0	1
	2			
	3			
	4			
2007	5	7	1	0
	6	6	1	0
	7	8	1	0
	8	8	1	0
	9	1	1	0
	10	0	1	0
	11	0	0	0
	12	0	0	0
Sub Total		30	6	0
2020	13	7	0	0
	14	8	0	0
	15	8	0	0
	16	8	0	0
	17	4	0	0
	18	4	0	0
	19	3	0	0
	20	4	0	0
Sub Total		46	0	0
Grand Total		85	6	1

Note: The number in the table shows how many captains were favorable to the Question.

Table 8.2.11. Captain Answers to Question 5

Question 5. If you mind many fishing boats at South of the SANGIANG Island, how do you feel for passing at 4.(b) with safety?	
	Answer
Present	• Difficult • If meeting situation occurs and many fishing boats are at this area, serious risk (collision and grounding) shall appear. • Especially for northbound vessels, increase risk of grounding due to avoid fishing boats. Recommend TSS at both sides of Sangiang islands. • Passing with care. In case of squall and night time, S/B eng. and increase look out shall be considered. • If fishing boats stop or move slowly, feel not so danger. • I will change her co. to pass west side of Sangiang Island when northbound.

Table 8.2.12. Captain Answers to Question 6

Question 6. How do you think this location of TSS? (with TSS)	
	Answer
2007 and 2020	• TSS-1 is better. • Recommend above item 4-a (both side of the SANGIANG Island). • There was not enough room for loaded VLCC in case large course alterations are requested to avoid crossing ferry. • To avoid crossing vessels, I feel the width of TSS is not enough.(Case Ⅰ) • Enough room for VLCC(Ballast) at Daytime.(Case Ⅱ) • Since there is no difficulty of this space, this TSS is preferable and this location of TSS is better.(Case Ⅱ) • No necessity for single way due to few traffic. • Width of TSS is rather small.(Case Ⅰ) • It is better to provide the separation zone between separation lanes.(Case Ⅰ) • Proper lane width is from 1and 1/4 to 1 and 1/2.

Table 8.2.13. Captain Answers to Question 7

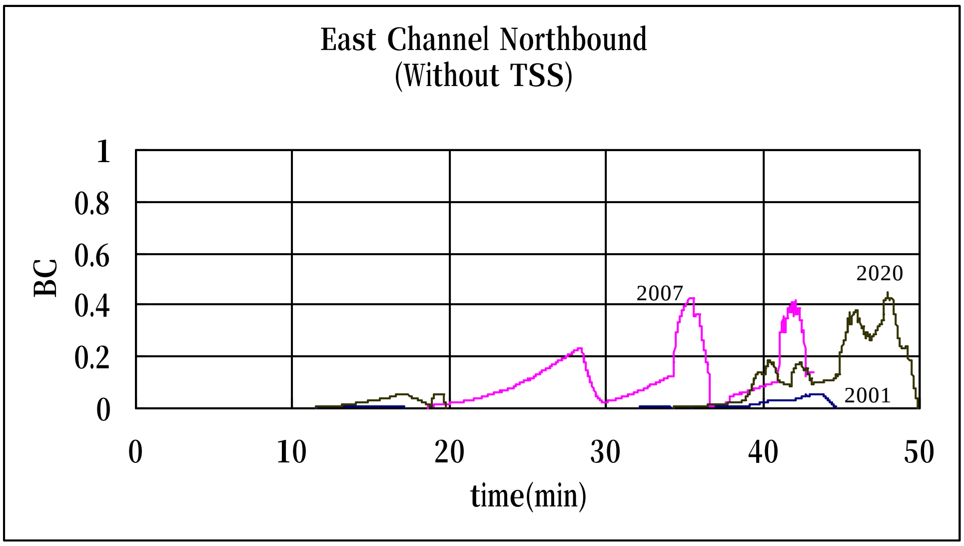
Question 7. Your comment for safe passage, if any.	
	Answer
2007 and 2020	• Safe avoiding area for crossing ferry must be considered for passage plan. • Sea speed under S/B eng. is necessary. •Set watch level 2 or 3.(watch level 2; Increase lookout, watch level 3: increase officer as lookout.) • Must keep S/B full speed (12.0 k't). • The necessity and effect of TSS is not understood well. • The width of traffic lane seems to be reasonable. (Case II) • The width of traffic lane is not enough.(Case I) • Daylight operation is preferred. • Some system to inform crossing ferry to keep clear of large vessels in TSS. • In case there are many crossing vessels, it may be very dangerous. • To avoid other vessels by altering the course, a sufficient room is necessary. • It is not realistic to separate completely the traffic in single way. • It is better that North Bound lane & South bound lane have a separate area.

8.2.13. Rating by Blocking Coefficients of Avoiding Action (Stage-1, 2)

(1) East channel Northbound

Rating by blocking coefficients is shown in **Figure 8.2.12.**

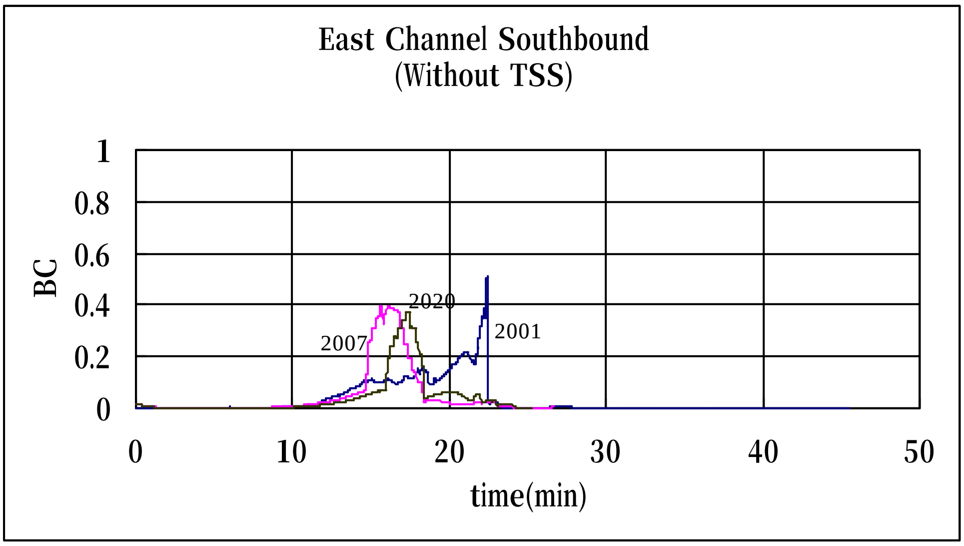
Figure 8.2.12. East Channel Northbound



(2) East channel Southbound

Rating by blocking coefficients is shown in **Figure 8.2.13.**

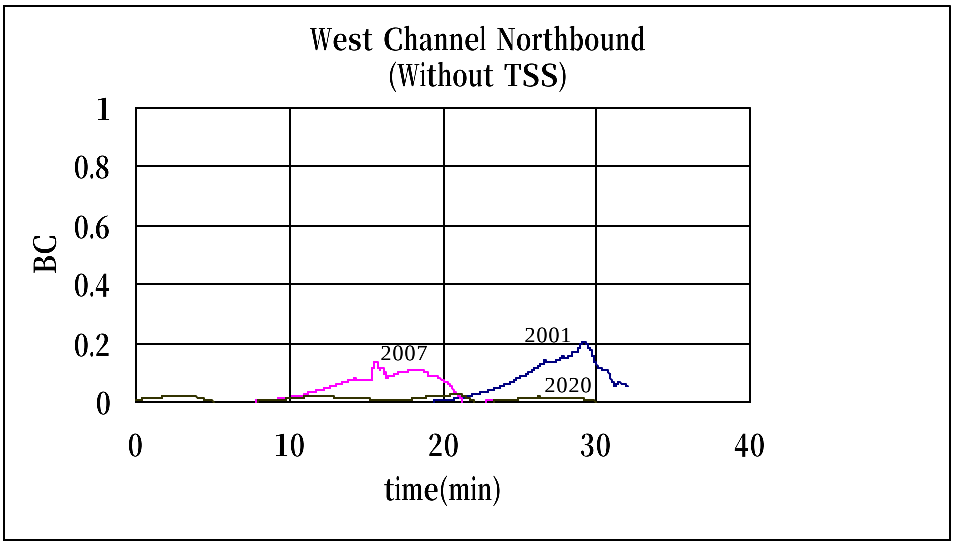
Figure 8.2.13. East Channel Southbound



(3) West channel Northbound

Rating by blocking coefficients is shown in **Figure 8.2.14.**

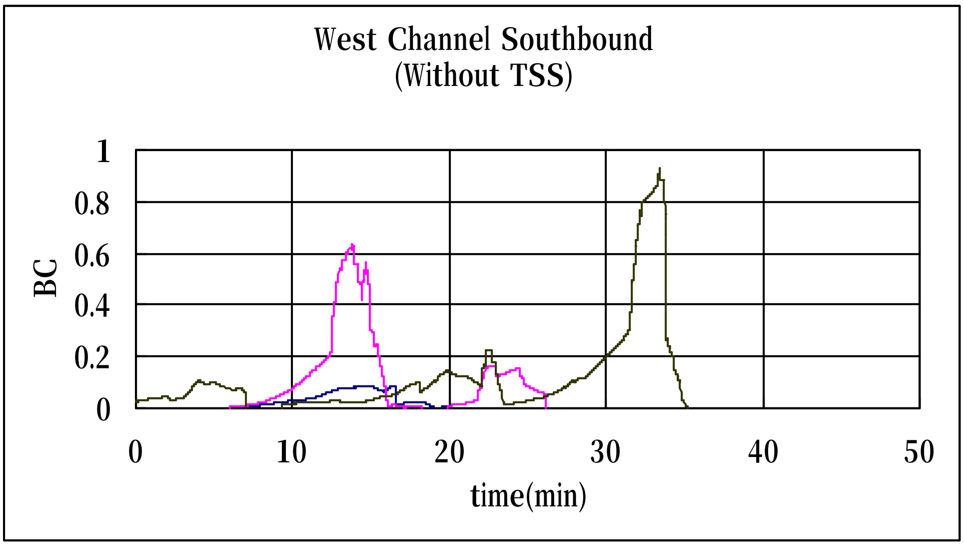
Figure 8.2.14. West Channel Northbound



(4) West channel Southbound

Rating by blocking coefficients is shown in **Figure 8.2.15.**

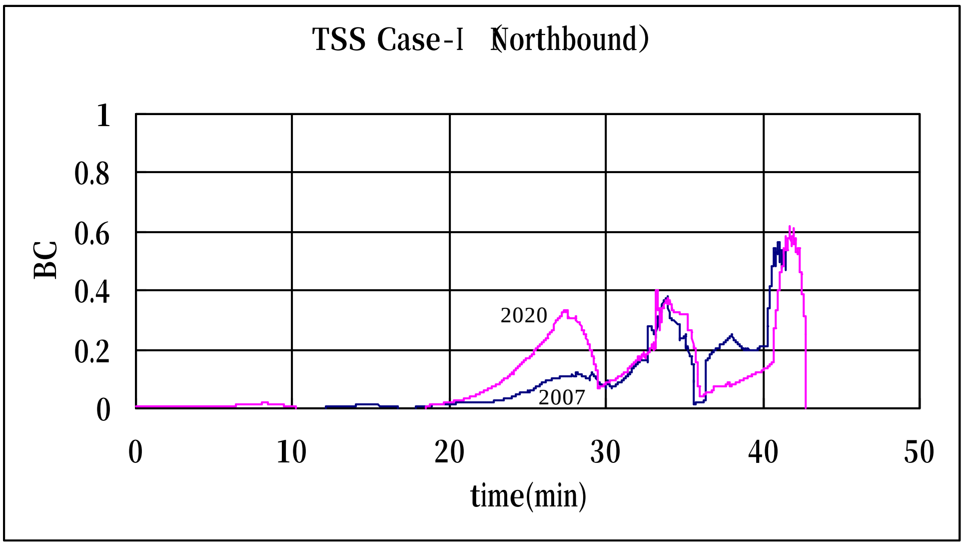
Figure 8.2.15. West Channel Southbound



(5) TSS-Ⅰ North bound

Rating by blocking coefficients is shown in **Figure 8.2.16.**

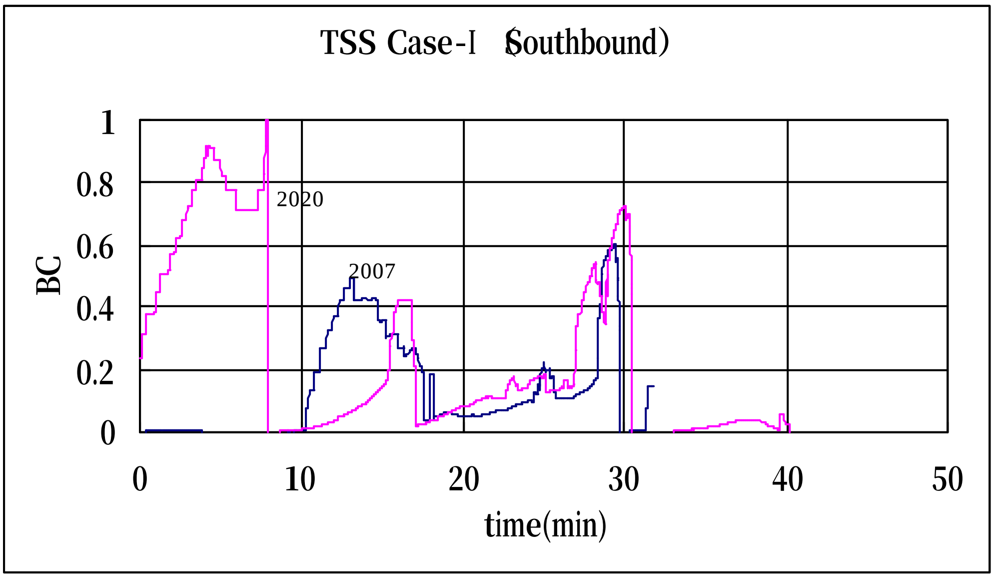
Figure 8.2.16. TSS-Ⅰ Northbound



(6) TSS-Ⅰ Southbound

Rating by blocking coefficients is shown in **Figure 8.2.17.**

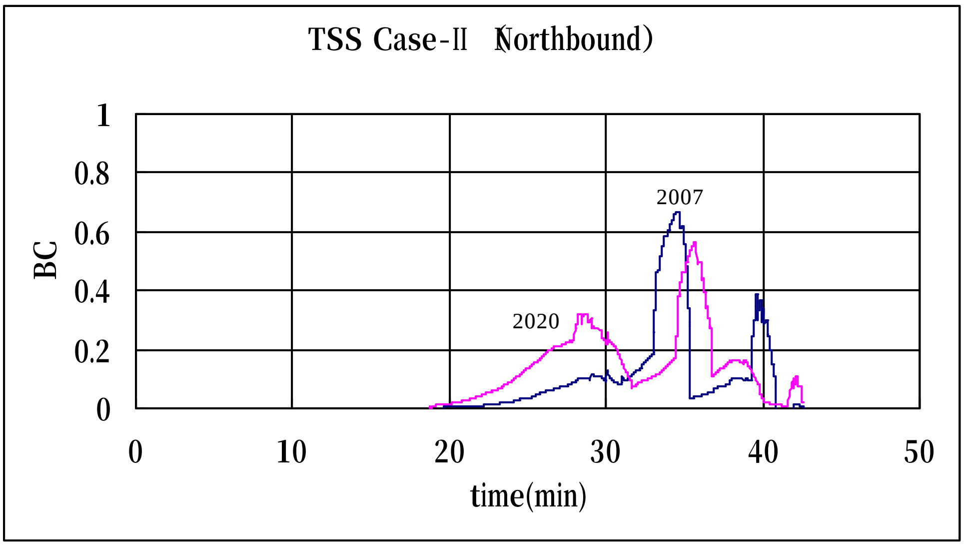
Figure 8.2.17. TSS-Ⅰ Southbound



(7) TSS-Ⅱ Northbound

Rating by blocking coefficients is shown in **Figure 8.2.18.**

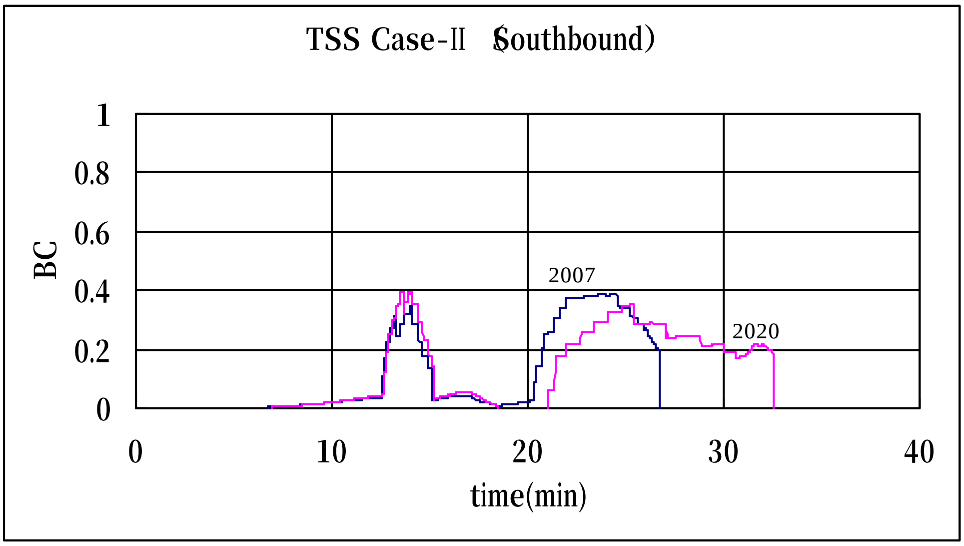
Figure 8.2.18. TSS-Ⅱ Northbound



(8) TSS-Ⅱ Southbound

Rating by blocking coefficients is shown in **Figure 8.2.19.**

Figure 8.2.19. TSS-Ⅱ Southbound



8.2.14. 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 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 engaged in fishing.

④ Almost 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 coefficients of avoiding action

① Maximum blocking coefficients without TSS, 0.5 in 2001, 0.6 in 2007, 0.9 in 2020, is getting worse as the years go by.

② Maximum blocking coefficients of case Ⅰ, 0.6 in 2007 0.9 in 2020, is getting worse as the years go by.

③ Maximum blocking coefficients of case Ⅱ, 0.65 in 2007, 0.55 in 2020.

(3) Overall rating

From the results of simulation experiments, followings are described.

① Case II have advantage on the point of blocking coefficients.

② Case I, II have no meeting ships at TSS due to the organization of traffic flows.

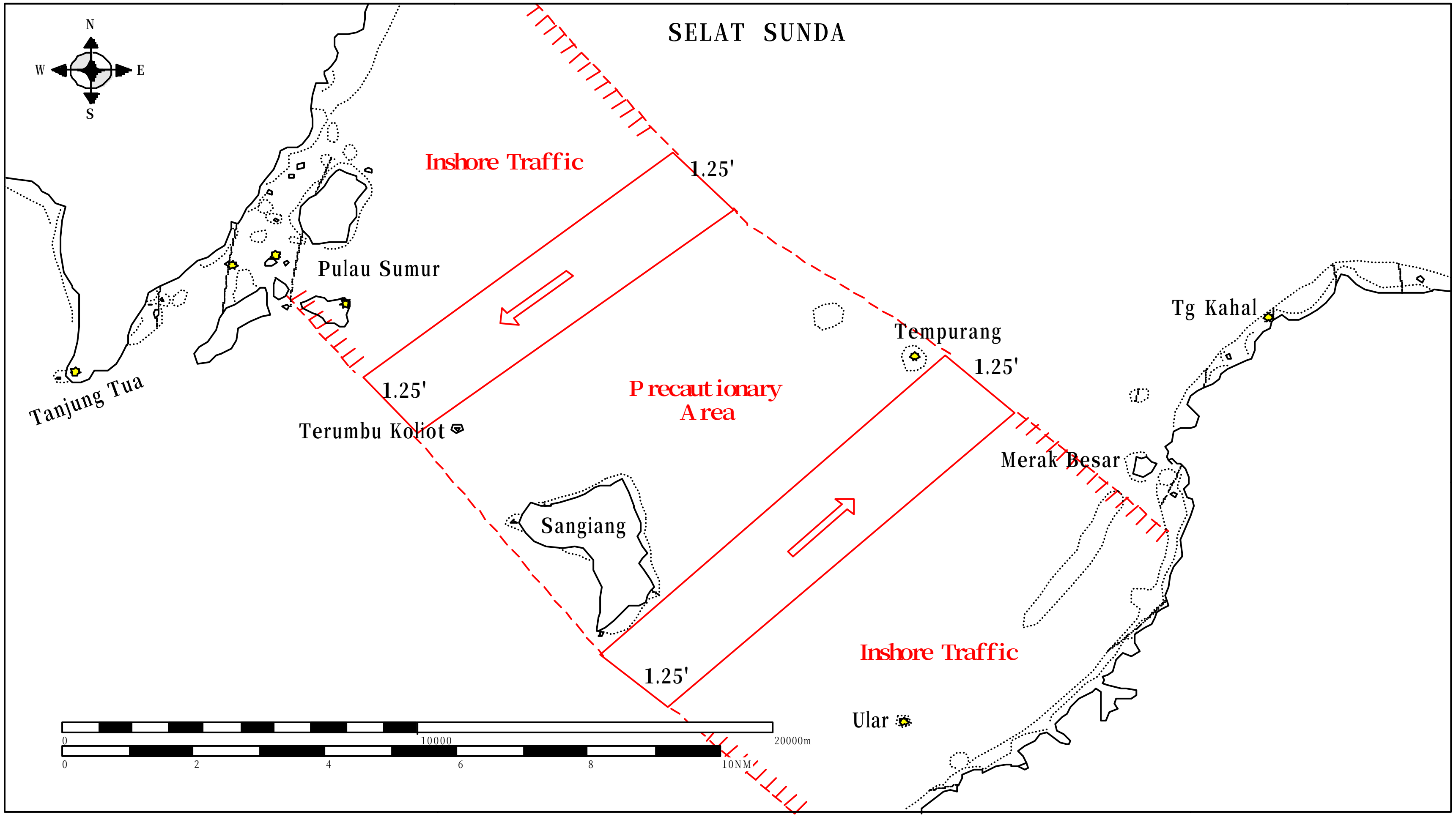
③ The width of TSS in case I is not enough to avoid crossing ferry.
On the point of captain of crossing ferry, case II is easy to maneuver due to the organization of traffic flow.

④ Inshore Traffic is needed for ships of less than 20 meters in length, sailing ships and fishing boats. Also a ship use Inshore Traffic when route to or from a port, offshore installation or structure, pilot station or any other place situated within the Inshore Traffic, or to avoid immediate danger. For that purpose, the study team judges that enough space should be needed for inshore traffic.

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 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 due to secure Inshore Traffic.
Proposed TSS is shown in **Figure 8.2.20**.

Figure 8.2.20 Proposed TSS



8.3. Improvement of Marine Casualty Statistics

8.3.1. Method of Marine Casualty Investigation

In order to consider the measures for preventing marine casualties, it is essential to collect all necessary data of daily marine accidents and to investigate the causes and to analyze their yearly trends.

As already stated in **Section 2.7**. of **Chapter 2 in Main Report Volume 1 Part 1**, the conditions of current marine casualty statistics in DGSC is far from satisfactory because many accidents have not been listed when they are compared with the reports of newspapers and maritime court decision data.

To grasp all marine accidents in Indonesia, it is vital to make them clear by only one responsible organization in Indonesia. Currently they are individually collected by the Navy, the Marine and Aviation Police, BASARNAS through GAMAT and DGSC through DISNAV. There is no coordination in collecting accident data among them. 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. investigation of each marine casualty should be done by this form.

"The Code for the Investigation of Marine Casualties and Marine Incidents (res. A. 849(20))" was adopted in International Maritime Organization (IMO) in 1997. Amendments to the Code for the Investigation of Marine Casualties and Marine Incidents incorporating the Guideline for the Investigation of Human Factors in Marine Casualties and Marine Incidents was adopted in 1999 as resolution A. 884(21).

It is necessary to consider these IMO resolutions when making the form. IMO res. A. 849(20) and res. A. 884(21) are shown in Appendix 8.3.1.

It is desired to investigate the following accidents at sea as "Accident Resulting in Injury or Death" following the examples of marine casualty.

(1) An accident involving person falling overboard, for example falling overboard, injury, illness, poisoning, etc. (except accident caused by marine casualty)
(2) An accident occurred in seashore, for example an accident during swimming, working, fishing etc. (except accident of person on board)

8.3.2. Items of Marine Casualty Investigation

"Marine Casualty Investigation Form" that is standardized, should be covered with the following items at least:

(1) Place, Date and Time of occurrence

(2) Kind of marine casualty (to classify; Collision, Stranding, Engine Trouble, Fire, Flooding, Capsizing, Propeller Trouble, Rudder Trouble, Missing and others)

(3) Particulars of the ship involved in the casualty (name, nationality, gross tonnage, full length, kind, number of crew and passengers, material of hull, type and number of engines, etc.)

(4) Conditions of the ship casualty (loading, navigation instrument, radio equipment, life saving equipment, etc.)

(5) Movements of the ship (ports of departure and destination, movement and speed just before casualty, etc.)

(6) Weather conditions of the scene

(7) Cause of casualty (to classify; mistake of operation, mistake of handling of engine or cargo or fire, bad material or structure, inevitable accident, etc. and to subdivide each item again)

(8) Conditions of damage (hull, engine and cargo)

(9) Information of casualty (route, method and time)

(10) Rescue activities (number of vessels and aircraft for rescue and content of activity)

(11) Summary of casualty and rescue

8.3.3. 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 trends of marine casualties and evaluating effect of counter measures for the past marine accidents if any.

The statistics should be annually issued by DGSC after collecting data and arranging them in order for 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.

8.4. Improvement of Search and Rescue System

8.4.1. Reinforcement of SAR Coordination Function

Maritime SAR activities are performed under the coordinating umbrella of BASARNAS, accordingly SAR coordination functions belong to BASARNAS. This system itself might be effective if it works well. 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 under 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.

8.4.2. Reorganization of SAR System

GAMAT has the primary responsibility for the execution of maritime SAR activities. The command system for the patrol vessels of GAMAT Fleet under the direct control of the Headquarters is different from that for the patrol vessels of KANWIL or ADPEL.

Concerning SAR activities, the cooperation system between the SAR powers dispatched from GAMAT Fleet and SAR powers of regional units has already been established. But the cooperation system between regional units with each other has not been established yet.

If GAMAT plays the central role of maritime SAR activities also hereafter, GAMAT Headquarters must manage the movements of patrol vessels of the whole country and establish central administration system. And it is necessary to dispatch SAR powers from GAMAT Fleet to regional units and vice versa if required. Regional headquarters also need such functions as command and coordination.

The necessity of such operation system was indicated in "The Study on Maritime Safety Plan concerning Search and Rescue" issued in 1989, too. But it has not been established so far. It is necessary to establish the operation system as early as possible.

In addition, it is necessary to reconsider the arrangement of regional units and patrol vessels corresponding to the tends of casualties.

8.4.3. 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. (**refer to PART Ⅰ CHAPTER 9 Table 9.3.3. and Table 9.3.4.**)

Thinking about the delay of the master plan, it will be difficult to implement by the target year. However, it is desired 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.

8.4.4. Efficient Arrangement of SAR Units

For the efficient operation of limited SAR units, it is effective to consider rearrangement the SAR unit bases and to station SAR vessels in the sea area, where marine casualties occur frequently based on the result of marine casualty investigation.

Also concerning the sea areas with busy vessel traffic, they should be regarded as important sea areas and SAR units should be deployed intensively. Because marine casualties in such sea areas may give serious effects on many vessels.

8.4.5. 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 proper SAR coordination.

8.4.6. Survey Concerning SAR Activities

In order to improve SAR activities, it is necessary to analyze the results of the activities and at the same time to evaluate whether they have been properly carried out or not. For the purpose, it is also necessary to examine the progress of rescue operation along with the investigation of casualties. The results should be properly recorded for the future activities.

8.5. 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.

8.5.1. 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 8.5.1**. as an example

(3) Proposed Survey Area

Proposed survey sites are as follows and shown in **Figure 8.5.1**.

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

8.5.2. 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 8.5.1. Blank Form of Log Sheet for Marine Traffic Density Survey

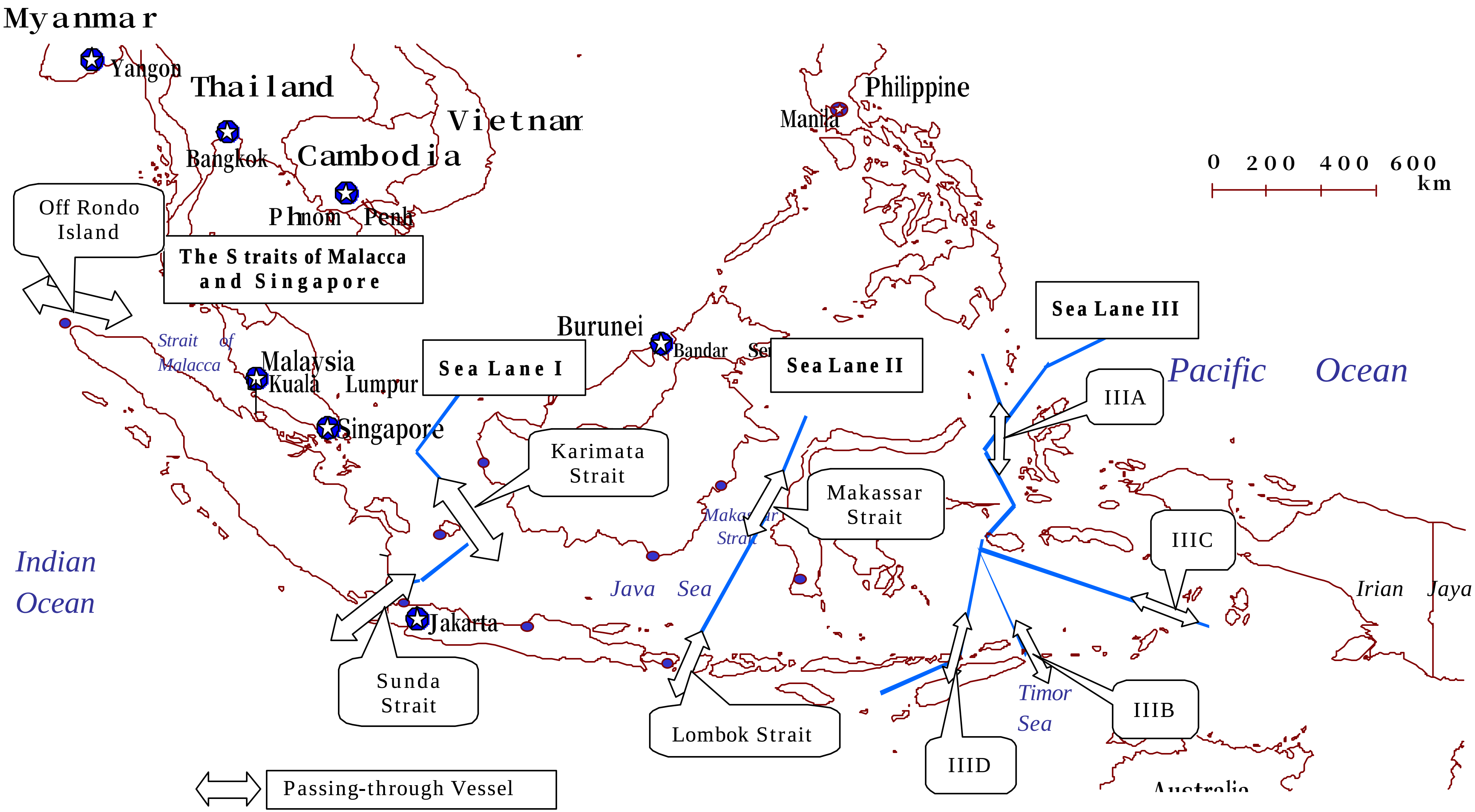
Data Log Sheet for Marine Traffic Survey   Site Area

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

Figure 8.5.1. Proposed Site Map for Marine Traffic Density Survey in the Straits of Malacca and Singapore, Sea Lane I / II / III



APPENDICES

Appendix 1.1.1.

Rehabilitation and Improvement of Visual Aids to Navigation in Master Plan (Lighthouse)

NO.	DSI No.	Location	Construction (Rehab.) Year	Age	Operation Status	Lantern Condition	Power Supply condition	Structure Condition	DUP	DISNAV	Latitude	Longitude	Structure Height (m)	Phase	Remaks
1	10	Ie. Meule	1974	27	1	0	0	0	0	Sabang	05-53-48N	095-19-48E	3	1	
2	11	Rondo	1984	17	1	0	0	0	1	Sabang	06-04-02N	095-06-50E	*	1	
3	77	P. Bunta	1980	21	1	0	0	0	1	Sabang	05-33-11N	095-09-05E	50	1	
4	84	Ujung Pidie	1987	14	0	0	0	0	1	Sabang	05-30-00N	095-52-60E	20	1	
5	960	P.Berhala	1978	23	1	0	0	0	0	Tg.Pinang	00-52-26S	104-24-30E	21	1	
6	1000	Tunjuk I	1975	26	1	1	1	0	1	Tg.Pinang	00-56-41N	104-12-10E	16	1	
7	1110	Tunjuk II	1975	26	1	1	1	0	1	Tg.Pinang	01-13-02N	104-34-30E	*	1	
8	1980	Tg. Rotan	1991	10	1	0	0	0	0	Pontianak	02-40-33S	110-02-20E	30	2	Improvement (LB to LH)
9	2025	P. Pengiki	1982	19	1	1	1	0	1	Pontianak	00-14-11N	108-02-25E	15	1	
10	2223	Tg.Sekatung	1984	17	1	0	0	0	0	Tg.Pinang	04-47-31N	108-01-14E	30	1	
11	2690	Temang	1971	30	1	1	1	0	1	Sibolga	00-21-21N	099-05-30E	22	2	
12	2790	P. Sigata	1971	30	1	1	1	0	1	Sibolga	00-07-04S	098-12-00E	35	2	
13	2931	Ujung Raja	1988	13	0	0	0	0	1	Sabang	03-44-15N	096-31-10E	40	1	
14	3070	Tegal I	1983	18	0	0	0	0(co)	1	Semarang	06-51-07S	109-08-13E	13	1	
15	3130	Tegal II	1982	19	1	0	0	0	1	Semarang	06-50-49S	109-08-17E	30	1	
16	3271	P. Panjang	1989	12	1	0	0	0	1	Semarang	06-34-18S	110-37-26E	40	1	
17	3290	P. Mandalika	1886	115	1	0	0	0	1	Semarang	06-22-22S	110-55-30E	16	1	
18	3300	P. Nyamuk	1980	21	1	0	0	0	1	Semarang	05-48-41S	110-11-20E	30	1	
19	4150	Buleleng	1978	23	1	0	0	1	0	Benoa	08-05-2S	115-05-30E	20	1	
20	4170	Lembongan	1974	27	1	1	1	0	0	Benoa	08-39-39S	115-27-30E	25	1	
21	4175	Sedihing	1989	12	1	0	0	1	1	Benoa	08-49-16S	115-35-42E	40	2	
22	4311	Tg. Sasar	1988	13	0	0	0	0(co)	1	Kupang	09-16-13S	119-56-30E	40	1	
23	4730	Tukong Hill	1980	21	1	1	1	0	1	Samarinda	01-16-08S	116-48-30E	8	1	
24	4950	Tg.Bunga	1980	21	1	0	0	0	1	Makassar	05-09-00S	119-24-00E	40	1	
25	5150	Sambit Pada	1989	12	1	0	0	1	1	Tarakan	01-46-23N	119-01-60E	40	2	
26	5444	P.Miangas	1977	24	1	1	1	0	1	Manado/Bitung	05-33-25N	126-35-38E	30	2	
27	5470	P.Pondang	1912 (1980)	21	1	0	0	1	1	Manado/Bitung	00-26-02N	124-28-30E	15	2	
28	5490	Gorontalo	1883 (1960)	41	1	0	0	0	1	Manado/Bitung	00-29-19N	123-03-18E	10	2	
29	5740	Menia	1920 (1982)	19	1	1	1	0	1	Kupang	10-25-25S	121-51-60E	10	2	
30	5750	Ba'a	1912 (1980)	21	1	0	0	0	1	Kupang	10-43-22S	123-02-60E	16	2	
31	5770	Kupang	1921 (1981)	20	1	1	1	0	1	Kupang	10-10-06S	123-34-30E	10	2	
32	5800	Tg.kurung	1912 (1974)	27	1	0	0	1	1	Kupang	10-07-04S	123-26-30E	16	2	
33	6190	Amsterdam Pu.Miossu	1953	48	1	0	0	1	0	Sorong	00-20-13S	132-10-20E	17	2	Improvement (LB to LH)
34	6205	P.Adi	1981	20	0	0	0	0(co)	0	Sorong	04-18-15S	133-37-10E	20	1	
35	6454	Isyuma / P. Liki	1984	17	1	0	0	1	1	Jayapura	01-34-34S	138-43-05E	40	2	

Note: “0” and “1” of Operation Status show “Out of Services” and “In Services”, respectively.
“0” of Lantern Condition, Power Supply Condition and Structure Condition shows being degrading, Damaged or Collapsed.
“1” shows good.

Appendix 1.1.2.

Rehabilitation and Improvement of Visual Aids to Navigation in Master Plan (Light Beacon)

No.	DSI No.	Location	Construction Year	Age	Operation Status	Lantern Condition	Power Supply Condition	Structure Condition	DUP	Latitude	Longitude	Structure Height (m)	On/ Offshore	DISNAV	Phase	Remarks
1	150	Kuala Langsa	1980	21	0	0	0	0	1	04-32-41N	098-03-02	12	Offshore	Belawan	1	
2	160	Kuala Langsa	1980	21	0	0	0	0	1	04-33-08N	098-03-36	8	Offshore	Belawan	1	
3	180	Kuala Langsa	1980	21	0	0	0	0	1	04-33-33N	098-04-22	10	ON	Belawan	1	
4	190	Kuala Langsa	1980	21	0	0	0	0	1	04-33-01N	098-03-56	18	ON	Belawan	1	
5	390	Belawan Deli	1983	18	0	0	0	0	1	03-48-54N	098-43-00	5.5	Offshore	Belawan	1	
6	400	Belawan Deli	1983	18	0	0	0	0 (Collapsed)	1	03-48-06N	098-43-15	5.5	Offshore	Belawan	1	
7	410	Belawan Deli	1983	18	1	0	0	1	1	03-47-22N	098-43-38	12	Offshore	Belawan	1	
8	450	Sungai Nunang	1979	22	0	0	0	0 (Collapsed)	0	03-47-18N	098-40-46	10	Offshore	Belawan	1	
9	451	Sungai Nunang	1984	17	0	0	0	0 (Collapsed)	0	03-47-30N	098-40-42	10	Offshore	Belawan	1	
10	510	Tg.Tiram	1984	17	1	0	0	1	1	03-14-54N	099-35-19	10	Offshore	Belawan	1	
11	550	Bagan Asahan	1977	24	1	0	0	1	1	03-02-46N	099-51-56	15	Offshore	Belawan	1	
12	551	S.Asahan Depan	1993	8	0	0	0	0 (Collapsed)	0	03-01-44N	099-51-40	10	Offshore	Belawan	1	
13	631	Morong	1979	22	1	1	1	0	0	01-55-10N	101-46-25	10		Dumai	3	
14	650	Tg.Leban	1991	10	0	0	0	0	1	01-39-30N	101-50-30	10	ON	Dumai	1	
15	672	Bengkalis strait	*		0	0	0	0 (Collapsed)	1	01-24-55N	102-09-55	10	Offshore	Dumai	3	
16	675	Selat Rupat C	1984	17	1	0	0	1	0	01-32-14N	101-54-33	30		Dumai	2	
17	677	Selat Rupat E	1991	10	0	0	0	0	1	01-41-23N	101-48-09	20	ON	Dumai	1	
18	679	Selat Rupat G	1991	10	0	0	0	0	1	01-41-30N	101-47-53	20	Offshore	Dumai	1	
19	729	Sei.Siak	*		0	0	0	0 (Collapsed)	1	01-14-11N	102-10-14	10	Offshore	Dumai	3	
20	740	Sei Siak	1984	17	0	0	0	0 (Collapsed)	0	01-12-30N	102-10-00	10	Offshore	Dumai	1	
21	750	Sei.Siak	1961	40	0	0	0	0	0	01-11-30N	102-09-30	10	Offshore	Dumai	1	
22	751	Sei.Siak	*		0	0	0	0 (Collapsed)	1	01-07-52N	102-09-31	10	Offshore	Dumai	3	
23	752	Sei.Siak	*		0	0	0	0 (Collapsed)	1	01-07-52N	102-09-33	10	Offshore	Dumai	3	
24	921	Tg.Datuk	*		0	0	0	0 (Collapsed)	1	00-00-44N	103-48-20	30	Offshore	Dumai	3	
25	928	Tg.Bakau	1978	23	0	0	0	1	1	00-20-00S	103-47-30	10	Offshore	Dumai	1	
26	929	Tembilahan	1982	19	1	1	1	0	0	00-20-00S	103-09-18	10	Offshore	Dumai	2	
27	940	Speck Rock	1988	13	0	1	1	0	0	00-36-48N	104-06-06	10	Offshore	Tg.Pinang	2	
28	981	Mentigi	1983	18	0	1	1	1	0	01-03-45N	104-13-00	30		Tg.Pinang	2	
29	1010	Tunjuk II	1975	26	1	1	1	0	0	00-56-26N	104-12-00	20		Tg.Pinang	2	
30	1088	P.Kambat	1989	12	0	0	0	0 (Collapsed)	1	00-48-30N	104-39-54	10	Offshore	Tg.Pinang	1	
31	1112	Kr.Heluputan	1992	9	0	0	0	0 (Collapsed)	0	00-37-15N	105-08-30	10	Offshore	Tg.Pinang	1	
32	1160	S. Daik	1990	11	1	1	1	0	0	00-13-30N	104-78-00	10		Tg.Pinang	2	
33	1170	Pelab. Penuba	1990	11	1	1	1	0	0	00-19-10N	104-27-50	10		Tg.Pinang	2	
34	1180	Pelab. Dabo	1990	11	0	0	0	0 (Collapsed)	0	00-29-30S	104-33-30	10	ON	Tg.Pinang	1	
35	1190	P.Saya	1994	7	0	0	0	0 (Collapsed)	0	00-46-50S	104-55-58	20		Tg.Pinang	1	
36	1270	Hendrik	1982	19	0	0	0	0	0	01-58-00S	104-57-10	20	ON	Palembang	1	
37	1271	Tg. Kampeh	1980	21	0	0	0	0 (Collapsed)	0	02-11-27S	104-54-04	20	ON	Palembang	1	
38	1300	Bak I	1996	5	1	0	0	0	1	02-13-11S	104-55-34	10	Offshore	Palembang	1	
39	1310	Bak II	1981	20	0	0	0	0 (Collapsed)	1	02-12-50S	104-55-42	20	Offshore	Palembang	1	

Appendix 1.1.2.

Rehabilitation and Improvement of Visual Aids to Navigation in Master Plan (Light Beacon)

No.	DSI No.	Location	Construction Year	Age	Operation Status	Lantern Condition	Power Supply Condition	Structure Condition	DUP	Latitude	Longitude	Structure Height (m)	On/ Offshore	DISNAV	Phase	Remarks
40	1590	Tg. Selokan	1971	30	1	0	0	1	1	02-23-00S	105-37-00	8	ON	Tg. Priok	5	
41	1682	Maspari	1986	15	0	0	0	0 (Collapsed)	0	03-13-08S	106-13-00	40	ON	Tg. Priok	1	
42	1684	Tg. Menjangan	1995	6	0	0	0	1	0	03-49-14S	106-00-03	10	ON	Tg. Priok	1	
43	1687	Tg. Bungin	1999	2	0	0	0	1	0	04-33-28S	106-03-29	10	ON	Tg. Priok	1	
44	1689	Gs. Serdang	1994	7	0	0	0	1	0	05-04-30S	106-16-36	10	ON	Tg. Priok	1	
45	1700	Beting Raja	1971	30	1	0	0	0	0	05-12-30S	106-44-20	10	Offshore	Tg. Priok	2	
46	1708	Tg. Priok	1993	8	0	0	0	0 (Collapsed)	0	06-05-41S	106-52-40	10	ON	Tg. Priok	1	
47	1710	Beting Eka	1792	9	0	0	0	0 (Collapsed)	1	05-17-32S	106-54-30	10	Offshore	Tg. Priok	1	
48	1740	Tg. Kerawang	1979	22	0	0	0	0 (Collapsed)	1	05-54-18S	107-00-28	10	Offshore	Tg. Priok	1	
49	1751	P. Putri	1983	18	0	0	0	0	0	06-04-07S	106-51-18	10	ON	Tg. Priok	1	
50	1752	Kr. Lamteri	1983	18	0	0	0	0	0	06-04-25S	106-49-50	10	ON	Tg. Priok	1	
51	1820	Pel. Pertamina	1982	19	0	0	0	0	0	06-05-49S	105-53-41	10	ON	Tg. Priok	1	
52	1821	Pel. Pertamina	1982	19	0	0	0	0 (Collapsed)	0	06-05-38S	106-54-18	10	ON	Tg. Priok	1	
53	1822	Pel. Pertamina	1982	19	0	0	0	0 (Collapsed)	0	06-05-51S	106-54-14	10	ON	Tg. Priok	1	
54	1823	Pel. Pertamina	1985	16	0	0	0	0 (Collapsed)	0	06-05-40S	106-53-41	10	ON	Tg. Priok	1	
55	1831	Kr. Belikat	1995	6	0	0	0	1	0	02-28-00S	106-58-20	20	ON	Palembang	1	
56	1910	Tg. Pandang	1973	28	0	0	0	0 (Collapsed)	0	02-44-10S	107-35-42	10	Offshore	Tg. Priok	1	
57	1911	Kr. Tanjung Pandan	1993	8	0	0	0	0 (Collapsed)	0	02-43-58S	107-35-30	10	Offshore	Palembang	1	
58	1916	Magdalena	1994	7	0	0	0	0 (Collapsed)	0	02-01-18S	106-32-24	10	ON	Palembang	1	
59	1950	Pangkal baran depan	1979	22	0	0	0	0	0	02-05-40S	106-09-57	20	Offshore	Palembang	1	
60	1970	Fox Bank	1989	12	1	0	0	1	1	03-30-40S	110-11-00	10	Offshore	Tg. Priok	1	
61	2010	Kanis	1973	28	0	0	0	0 (Collapsed)	0	02-37-18S	108-12-20	10	ON	Tg. Priok	1	
62	2037	S. Datu Belakang	1991	10	1	1	1	0	0	00-07-35S	108-36-40	30		Pontianak	2	
63	2041	Telok Air	1995	6	0	0	0	0 (Collapsed)	0	00-40-54S	109-22-10	10	ON	Pontianak	1	
64	2042	Telok Air	1997	4	0	0	0	0 (Collapsed)	0	00-12-32S	109-23-50	10	ON	Pontianak	1	
65	2043	Telok Air	1997	4	0	0	0	0 (Collapsed)	0	00-43-48S	109-27-11	10	ON	Pontianak	1	
66	2044	Telok Air	1997	4	0	0	0	0 (Collapsed)	0	00-45-12S	109-25-50	10	ON	Pontianak	1	
67	2045	Telok Air	1997	4	0	0	0	0 (Collapsed)	0	00-44-00S	109-32-55	10	ON	Pontianak	1	
68	2068	Telok Air	1983	18	0	0	0	0 (Collapsed)	0	00-00-16N	109-18-04	10	ON	Pontianak	1	
69	2075	Wajok hulu	1986	15	0	0	0	0 (Collapsed)	0	00-00-55N	109-16-45	10	ON	Pontianak	1	
70	2076	Sei Serok	1986	15	1	0	0	0	0	00-00-10N	109-17-36	10		Pontianak	2	
71	2080	Lemanbudi	1986	15	0	0	0	0 (Collapsed)	0	01-16-20S	108-52-25	10	ON	Pontianak	1	
72	2091	Sambas Belakang	1993	8	0	0	0	0 (Collapsed)	0	01-11-29N	108-59-02	10		Pontianak	1	
73	2132	Pemangkat	1977	24	0	0	0	0 (Collapsed)	0	01-11-52N	108-55-10	10	ON	Pontianak	1	
74	2135	Panjang Ketapang	1983	18	1	1	1	0	0	01-45-51S	109-56-32	10		Pontianak	3	
75	2136	Panjang Ketapang Rear	1983	18	1	1	1	0	0	01-45-58S	109-56-40	10		Pontianak	3	
76	2138	Kerbau Ketapang	1985	16	1	1	1	0	0	01-45-31S	109-56-07	10		Pontianak	2	

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No.	DSI No.	Location	Construction Year	Age	Operation Status	Lantern Condition	Power Supply Condition	Structure Condition	DUP	Latitude	Longitude	Structure Height (m)	On/ Offshore	DISNAV	Phase	Remarks
77	2139	Kerbau Ketapang	1989	12	0	0	0	0 (Collapsed)	0	01-45-24S	109-56-03	10		Pontianak	1	
78	2143	Kr. P. Buan	1994	7	0	0	0	0 (Collapsed)	0	01-28-05S	109-03-00	10	ON	Pontianak	1	
79	2180	Pel. Serasan	1990	11	0	0	0	0	0	02-29-50N	109-00-43	20		Tg.Pinang	2	
80	2201	Kr.Serval	1988	13	0	0	0	0 (Collapsed)	0	03-04-30N	108-02-04	10	Offshore	Tg.Pinang	1	
81	2272	Merak Besar	1976	25	0	0	0	0 (Collapsed)	1	05-56-04S	105-59-31	10	Offshore	Tg. Priok	1	
82	2310	Telk Betung	1971	30	1	0	0	1	1	05-28-00S	104-16-30	20	ON	Tg. Priok	5	
83	2330	Teluk Betung	1971	30	1	0	0	1	0	05-28-03S	105-18-40	10	Offshore	Tg. Priok	2	
84	2340	Teluk Betung	*		0	0	0	0 (Collapsed)	1	05-28-02S	105-18-45	10	Offshore	Tg. Priok	3	
85	2381	Tg. Tua	1981	20	0	0	0	1	0	05-54-22S	105-43-00	20	ON	Tg. Priok	1	
86	2420	Gs. Jong	1974	27	0	0	0	0	1	05-51-09S	106-38-44	10	Offshore	Tg. Priok	1	
87	2430	Kroe	1971	30	0	0	0	0	0	05-11-00S	103-56-00	10	ON	Tg. Priok	1	
88	2477	Malakoni	1993	8	0	0	0	0 (Collapsed)	0	05-20-26S	102-17-19	10	ON	Tg. Priok	1	
89	2600	Bukit Tampak	1979	22	1	1	1	0	0	01-00-23S	100-22-52	10		Tlk. Bayur	2	
90	2671	Ujung Tiku	1982	19	1	0	0	0	0	00-25-28S	099-53-32	20		Tlk. Bayur	2	
91	2672	Kr. Ingaris	1990	11	1	0	0	0	0	00-29-10S	099-51-30	10	Offshore	Tlk. Bayur	2	
92	2673	Gs. Moller	1990	11	0	0	0	0	1	00-04-20S	099-24-00	10	Offshore	Tlk. Bayur	1	
93	2691	Uj.Marit	1990	11	0	0	0	0	0	00-00-56N	098-15-40	20	ON	Sibolga	1	
94	2713	Natal	1983	18	1	1	1	0	0	00-33-00N	099-06-12	10		Sibolga	2	
95	2713.1	P. Unggas	1996	5	1	1	1	0	0	00-36-34N	099-03-10	10		Sibolga	2	
96	2714	P.Sidakah	1984	17	0	0	0	0	1	00-51-34N	098-56-18	20	ON	Sibolga	1	
97	2730	Ujung Silabi	1987	14	1	1	1	0	0	02-01-41N	098-15-35	10		Sibolga	2	
98	2735	P. Bintana	1993	8	0	0	0	0	0	01-28-35N	098-10-20	20	ON	Sibolga	1	
99	2760	P. Baleh	1984	17	1	0	0	0	0	02-17-36N	097-24-12	10		Sibolga	1	
100	2761	Kr. Panjang	1976	25	1	0	0	0	0	02-16-46N	097-23-23	10		Sibolga	2	
101	2770	Batu Makele	1979	22	1	1	1	0	0	00-03-18S	098-17-29	10		Sibolga	2	
102	2780	Batu Makele	1979	22	1	1	1	0	0	00-03-40S	098-17-36	18		Sibolga	2	
103	2791	Gs.Ular	1984	17	1	1	1	0	0	00-05-10N	098-56-55	10	Offshore	Sibolga	2	
104	2800	P.Tello	1979	22	1	1	1	0	0	00-03-08S	098-16-48	20		Sibolga	2	
105	2820	P.Hinako	1981	20	1	1	1	0	0	00-52-38N	097-20-36	20		Sibolga	2	
106	2831	Gn.Sitoli	1984	17	1	1	1	0	0	01-18-12N	097-36-12	20		Sibolga	2	
107	2834	Gs.Oma Lehawa	1986	15	1	1	1	0	0	01-28-00N	097-12-10	10	Offshore	Sibolga	3	
108	2840	Sikabaluan	*		0	0	0	0 (Collapsed)	1	01-07-18N	098-59-42	10	Offshore	Tlk. Bayur	1	
109	2850	Gs.Baohi Lahewa	1981	20	0	0	0	0	1	01-26-05N	097-10-10	10	Offshore	Sibolga	1	
110	2855	P. Sumbawga	1992	9	0	0	0	0	0	00-54-26N	098-00-48	30	ON	Sibolga	1	
111	2870	Tg.Hele	1974	27	0	0	0	0	1	00-32-40N	097-49-17	10	ON	Sibolga	1	
112	2881	Krueng Rangsa Sinabang	1976	25	1	1	1	0	0	02-31-44N	096-23-56	10		Sabang	2	
113	2960	P. Rusa	1978	23	1	0	0	0	0	05-16-40N	095-12-00	10	ON	Sabang	1	
114	3062	Tg. Sengarong	1980	21	0	0	0	0	0	06-45-20S	108-49-10	10	Offshore	Tg. Priok	1	

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No.	DSI No.	Location	Construction Year	Age	Operation Status	Lantern Condition	Power Supply Condition	Structure Condition	DUP	Latitude	Longitude	Structure Height (m)	On/ Offshore	DISNAV	Phase	Remarks
115	3080	Tegal	1982	19	1	1	1	0	0	06-50-40S	109-08-06	20		Semarang	2	
116	3090	Trgal	1979	22	1	1	1	0	0	06-50-43S	109-08-08	20		Semarang	2	
117	3100	Tegal	1979	22	1	1	1	0	0	06-50-51S	109-08-10	10		Semarang	2	
118	3160	Pekolomgan	1984	17	1	1	1	0	0	06-51-26S	109-41-30	10		Semarang	2	
119	3180	Batanta	1989	12	1	1	1	0	0	06-51-20S	109-41-34	10		Semarang	3	
120	3270	Jepara	1984	17	1	1	1	0	0	06-35-04S	110-39-20	20		Semarang	3	
121	3273	Alur Ma. Pel. Juana	1991	10	0	0	0	0 (Collapsed)	1	06-39-00S	111-10-00	10	Offshore	Semarang	1	
122	3275	Juwana	1990	11	0	0	0	0	1	06-39-05S	111-10-30	10	ON	Semarang	1	
123	3276	Juana	1990	11	0	0	0	0	1	06-40-15S	111-10-30	10	ON	Semarang	1	
124	3277	Alur Ma. Pel. Juana	1991	10	0	0	0	0 (Collapsed)	0	06-40-18S	111-10-42	10	Offshore	Semarang	1	
125	3278	Alur Ma. Pel. Juana	1991	10	0	0	0	0 (Collapsed)	0	06-40-35S	111-10-29	10	Offshore	Semarang	5	
126	3293	Tg. Pudak	1986	15	0	0	0	0	0	05-53-21S	110-26-52	20		Semarang	1	
127	3608	Keramaian	1984	17	1	1	1	0	1	05-02-30S	114-37-00	20	ON	Surabaya	2	
128	3920	Pel. Panarukan	1971	30	1	0	0	1	0	07-42-00S	113-55-30	20		Surabaya	5	
129	4070	Tg. Pasir	1971	30	1	1	1	0	0	08-05-50S	114-26-05	10	Offshore	Benoa	2	
130	4122	Kr. Wuni Wates	1991	10	0	0	0	0	1	07-55-42S	110-06-16	30	ON	Cilacap	1	
131	4125	Tg. Sodong NK	1981	20	1	1	1	0	0	07-44-33S	108-59-21	20		Cilacap	2	
132	4167	Tg. Sari	1976	25	0	0	0	0	1	08-31-43S	115-30-17	20	ON	Benoa	1	
133	4185	Keramat Lebar	1986	15	1	1	1	0	0	08-44-22S	116-03-40	10		Benoa	2	
134	4190	Gendang	1992	9	0	0	0	0	0	08-45-06S	115-49-12	10	ON	Benoa	1	
135	4200	Petagan	1981	20	1	1	1	0	1	08-26-05S	116-45-17	20	Offshore	Benoa	1	
136	4201	Sekunci	1984	17	0	0	0	0	1	07-51-30S	117-12-30	20	ON	Benoa	1	
137	4220	Tg. Mankun	1994	7	0	0	0	0	1	09-00-38S	116-43-52	30	ON	Benoa	1	
138	4310	Waingapu	1981	20	1	1	1	0	0	09-38-02S	120-15-25	10		Kupang	2	
139	4331	Lawandau Kotawaringin	1987	14	0	0	0	0	0	02-55-25S	111-23-00	10	ON	Banjarmasin	1	
140	4336	Tg. Keluang	1990	11	1	0	0	0	0	02-54-15S	111-42-11	10	ON	Banjarmasin	1	
141	4337	Tg. Serambut	1987	14	1	0	0	0 (Collapsed)	1	02-59-11S	113-03-12	17	Offshore	Banjarmasin	1	
142	4338	Tg. Serambut	1986	15	0	0	0	0 (Collapsed)	1	02-59-24S	113-03-12	10	Offshore	Banjarmasin	1	
143	4468	Gosong Keramat	1993	8	0	0	0	1	0	03-32-06S	116-00-20	10	Offshore	Banjarmasin	1	
144	4630	Karang Suling	1990	11	1	1	1	0	0	02-22-30S	116-43-31	10		Samarinda	2	
145	4640	Aru Bank	1990	11	1	1	1	0	0	02-15-31S	116-40-00	10		Samarinda	2	
146	4641	Telk Apar	1985	16	0	0	0	0	0	02-02-42S	116-33-00	20	ON	Samarinda	1	
147	4645	Teluk Adang	1983	18	0	0	0	0	0	01-45-00S	116-28-20	10	ON	Samarinda	1	
148	4658	P. Seturian	1991	10	0	0	0	0	0	02-16-20S	117-39-40	10	ON	Samarinda	1	

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No.	DSI No.	Location	Construction Year	Age	Operation Status	Lantern Condition	Power Supply Condition	Structure Condition	DUP	Latitude	Longitude	Structure Height (m)	On/ Offshore	DISNAV	Phase	Remarks
149	4731	Balikpapan	1990	11	0	0	0	0	0	01-13-32S	116-48-20	10	ON	Samarinda	1	
150	4748	Tg. Nibung	1982	19	0	0	0	0 (Collapsed)	0	00-48-30S	117-17-51	10	ON	Samarinda	1	
151	4749	Tg. Nibung	1982	19	0	0	0	0	0	00-48-06S	117-17-45	20	ON	Samarinda	1	
152	4762	S. Marian	1984	17	1	1	1	0	0	00-34-54S	117-16-36	10		Samarinda	2	
153	4763	Kutai River	1990	11	0	0	0	0 (Collapsed)	0	00-34-20S	117-16-20	10		Samarinda	1	
154	4768	Mahakam River	1990	11	0	0	0	0 (Collapsed)	0	00-20-15S	117-29-42	10	ON	Samarinda	1	
155	4911	Sibald Bank	1994	7	0	0	0	0 (Collapsed)	1	05-46-00S	117-07-00	20	Offshore	Makassar	1	
156	4921	P. Tnakeke	1985	16	1	0	0	1	0	05-29-36S	119-19-08	10	Offshore	Makassar	4	
157	4990	Samalona	1982	19	1	0	0	1	0	05-07-30S	119-20-20	10	Offshore	Makassar	4	
158	5011	Bone Panambungan	1984	17	1	0	0	1	0	04-58-00S	119-21-20	20	Offshore	Makassar	4	
159	5012	Batu Nombongan	1985	16	0	0	0	0 (Collapsed)	0	04-52-45S	119-22-00	10	Offshore	Makassar	1	
160	5021	Pangka Mandra	1991	10	1	1	1	1	0	04-16-40S	119-17-30	10	Offshore	Makassar	3	
161	5042	Awerrange	*		1	0	0	1	0	04-13-55S	119-36-00	10		Manado/Bitung	4	
162	5043	Awerrange	*		1	0	0	1	0	04-13-55S	119-35-50	10		Manado/Bitung	4	
163	5112	Pel. Pantoloan	1978	23	1	0	0	1	0	00-42-12S	119-51-03	20		Manado/Bitung	4	
164	5160	Kr.Malalungun	1985	16	1	1	1	0	1	01-55-32N	118-26-40	10	Offshore	Tarakan	1	
165	5164	Muara pantai	1990	11	1	1	1	0	0	02-01-50N	117-51-18	10	Offshore	Tarakan	2	
166	5172	P. Pajang	1990	11	1	1	1	0	0	02-23-00N	118-12-10	10	Offshore	Tarakan	3	
167	5176	Tg.Ulingan	1992	9	0	0	0	0	1	02-12-08N	118-02-40	10	Offshore	Tarakan	1	
168	5311	Gs. Makassar Nunukan	1991	10	1	0	0	1	0	03-59-29N	117-56-58	10	Offshore	Tarakan	4	
169	5312	Tg.Harapan	1991	10	1	1	1	0	1	04-03-30N	117-45-05	10	Offshore	Tarakan	1	
170	5315	Tg. Ahus	1991	10	1	0	0	1	0	03-46-10N	117-56-39	20		Tarakan	4	
171	5320	Pel.Leok	1994	7	1	0	0	1	0	01-11-40N	121-25-40	20		Manado/Bitung	4	
172	5351	Pel.Inobonto	*		0	0	0	0 (Collapsed)	0	00-55-30N	124-06-00	20	ON	Manado/Bitung	1	
173	5410	Pel.Tagulandang	*		0	0	0	0 (Collapsed)	0	02-20-30N	125-23-00	20	ON	Manado/Bitung	1	
174	5440	Pel.Peta	*		0	0	0	0 (Collapsed)	0	03-39-30N	125-32-30	10	ON	Manado/Bitung	1	
175	5454	Selat Lembeh	1982	19	1	1	1	0	0	01-30-18N	125-14-53	20		Manado/Bitung	3	
176	5468	Pel.Belang	*		0	0	0	0 (Collapsed)	0	00-56-00N	124-47-00	20	ON	Manado/Bitung	1	
177	5469	Pel.Kotabunan	*		0	0	0	0 (Collapsed)	0	00-47-50N	124-38-31	20	ON	Manado/Bitung	1	
178	5492	Pel.Tilamuta	*		0	0	0	0 (Collapsed)	0	00-30-00N	122-20-11	20	ON	Manado/Bitung	1	
179	5495	Pel.Moutong	*		0	0	0	0 (Collapsed)	0	00-27-20N	121-13-30	20	ON	Manado/Bitung	1	
180	5520	Pel. Poso	1990	11	1	0	0	1	0	01-22-00S	120-45-00	20		Manado/Bitung	4	

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No.	DSI No.	Location	Construction Year	Age	Operation Status	Lantern Condition	Power Supply Condition	Structure Condition	DUP	Latitude	Longitude	Structure Height (m)	On/ Offshore	DISNAV	Phase	Remarks
187	5558	Karang Kenau	1995	6	1	1	1	0	0	01-46-22S	123-31-40	10	Offshore	Manado/Bitung	3	
188	5571	P. Batu Tenggara	1977	24	1	1	1	0	0	01-56-15S	121-22-00	10		Manado/Bitung	3	
189	5573	Tg.Mposo	1977	24	1	0	0	0	0	01-57-00S	121-32-30	20		Manado/Bitung	4	
190	5578	Bunk toko	1977	24	0	0	0	0 (Collapsed)	0	03-58-24S	122-36-23	10	ON	Kendari	1	
191	5579	Saponda	1984	17	1	0	0	1	0	03-58-24S	122-46-00	20		Kendari	4	
192	5581	Sappa Jambi	1982	19	1	0	0	0	0	03-58-30S	122-40-25	20	Offshore	Kendari	4	
193	5582	Tanjun Kendari	1977	24	1	1	1	0	0	03-58-50S	122-35-56	10		Kendari	3	
194	5583	Twelling Barat	1992	9	0	0	0	0 (Collapsed)	0	04-12-54S	122-55-00	10	Offshore	Kendari	1	
195	5584	Tweiling Timur	1983	18	1	1	1	0	0	04-12-46S	122-56-10	10	Offshore	Kendari	3	
196	5600	Krg.Raha	1983	18	1	0	0	1	0	04-50-50S	122-44-20	20	Offshore	Kendari	3	
197	5614	P.Siompu	1985	16	0	0	0	0 (Collapsed)	1	05-41-30S	122-27-40	20	ON	Kendari	1	
198	5673	Padamarang	1978	23	1	0	0	0	0	04-03-20S	121-22-48	10	Offshore	Kendari	1	
199	5682	Gosong Boni	1995	6	1	0	0	1	0	08-23-22S	122-14-05	10	Offshore	Kupang	4	
200	5711	P.Lowotobi	1982	19	1	0	0	1	0	08-36-12S	122-50-44	20		Kupang	4	
201	5712	P.Sarbete	1982	19	1	0	0	1	0	08-09-02S	123-01-10	20		Kupang	4	
202	5720	Pel.Kalabahi	1980	21	1	0	0	1	0	08-13-00S	124-31-00	20		Kupang	4	
203	5811	Pel.Atapupu	1982	19	1	0	0	1	0	08-59-42S	124-51-36	20		Kupang	4	
204	5851	Waitidal	1981	20	0	0	0	0 (Collapsed)	0	07-07-25S	131-43-14	20	ON	Ambon	1	
205	5861	Asatubun	1981	20	1	0	0	0	0	08-03-30S	131-16-18	20	ON	Ambon	4	
206	5882	Pel. Tual	1976	25	1	0	0	1	0	05-38-27S	132-44-12	30		Ambon	2	
207	5884	P.Ubur	1982	19	1	1	1	0	0	05-35-55S	132-43-47	10	Offshore	Ambon	3	
208	5886	Pel. Tual	1978	23	0	0	0	0	0	05-34-10S	132-40-16	20		Ambon	1	
209	5915	Kr.Dododahohe	1988	13	0	0	0	0 (Collapsed)	1	01-59-05S	128-12-36	10	Offshore	Ambon	1	
210	5959	Batu Sarip	1982	19	1	1	1	0	0	04-30-11S	129-53-03	10		Ambon	2	
211	5974	Daruba	*		0	0	0	1	0	02-35-55N	128-17-05	10	Offshore	Ambon	1	
212	5980	Hatilang	1978	23	0	0	0	0	0	02-47-20S	129-29-30	10	Offshore	Ambon	1	
213	6005	Tg. Yatung	1981	20	0	0	0	0	0	08-26-53S	140-18-26	20	ON	Merauke	1	
214	6008	Merauke	1992	9	0	0	0	0 (Collapsed)	0	08-28-36S	140-21-07	20	ON	Merauke	1	
215	6020	Ujung Digul	1991	10	0	0	0	0	1	06-55-58S	138-31-47	10	ON	Merauke	1	
216	6046	Ma.Keakwa	1985	16	0	0	0	0	1	04-45-21S	136-30-31	30	ON	Sorong	1	
217	6060	Pel.Fakfak	1989	12	0	0	0	0 (Collapsed)	0	02-56-16S	132-17-40	10	ON	Sorong	1	
218	6160	Kr.Membok	1980	21	0	0	0	0	1	01-24-25S	130-54-40	10	Offshore	Sorong	1	
219	6180	Rasi	1982	19	1	1	1	0	0	01-20-30S	136-37-30	20		Jayapura	3	
220	6200	Saokorem	1984	17	0	0	0	0	0	00-33-05S	133-09-00	30		Sorong	1	
221	6240	Kaironyel	1948	53	1	0	0	1	0	01-14-12S	131-06-42	10		Sorong	5	
222	6250	Segeran	1948	53	0	0	0	1	0	01-10-13S	131-06-42	10		Sorong	5	

Appendix 1.1.2.

Rehabilitation and Improvement of Visual Aids to Navigation in Master Plan (Light Beacon)

No.	DSI No.	Location	Construction Year	Age	Operation Status	Lantern Condition	Power Supply Condition	Structure Condition	DUP	Latitude	Longitude	Structure Height (m)	On/ Offshore	DISNAV	Phase	Remarks
223	6260	Unasinim	1949	52	0	0	0	1	0	01-11-23S	131-06-48	10		Sorong	5	
224	6280	Balbili	1948	53	0	0	0	0	1	01-05-30S	131-11-00	10	Offshore	Sorong	1	
225	6321	Karang Dua	1983	18	1	0	0	0	0	00-53-36S	131-15-30	10	Offshore	Sorong	5	
226	6351	Doom	1982	19	1	0	0	0	0	00-53-18S	131-14-04	10	Offshore	Sorong	3	
227	6390	Batanta	1948	53	1	0	0	1	0	00-54-36S	130-36-30	10		Sorong	2	
228	6409	P.Rani	1984	17	1	1	1	0	1	00-57-51S	135-30-17	20	ON	Jayapura	3	
229	6445	P.Naufi	1994	7	1	0	0	1	1	02-14-10S	136-15-10	30	ON	Jayapura	4	
230	132005	Rambu suar	1994	7	0	0	0	0 (Collapsed)	0	00-51-00N	107-37-06	10	ON	Pontianak	1	
231	132006	Rambu suar	1994	7	0	0	0	0 (Collapsed)	0	00-45-03N	107-19-200	10	ON	Pontianak	1	

Note: "0" and "1" of Operation Status show "Out of Services" and "In Services", respectively.
"0" of Lantern Condition, Power Supply Condition and Structure Condition shows being degrading, Damaged or Collapsed.
"1" shows good. *shows unknown.

Appendix 1.1.3.

Rehabilitation and Improvement of Visual Aids to Navigation in Master Plan (Light Buoy)

No.	No. (DSI)	Location	Establishment	Age	Operation Status	Condition of Lighting Apparatus	Energy	Condition of Power Supply	Range required	Color of Structure	Condition of Structure/ Buoy Body	ATN Office
1	82	Krueng Raya	1983	19	1	1	SC	1	4	Red	0	Sabang
2	320	Belawan Deli Alur Masuk	1971	31	0	0	A	0	6	Red/White V Strip	0	Belawan
3	641	Pelsu No1. Selat Bengkalis	1969	33	1	1	SC/EB	1	4	Green	0 (Broken)	Dumai
4	651	Pelsu No.5 Selat Bengkalis	1993	9	1	1	SC/EB	1	4	Green	0 (Damaged)	Dumai
5	693	Pelsu No.8 Selat Rupat	1994	8	1	1	SC/EB	1	4	Red	0 (Damaged)	Dumai
6	702	Pelsu No.18 Selat Rupat	1995	7	0	0 (Missing)	SC	0 (Missing)	4	Red	0 (Damaged)	Dumai
7	720	Pelsu Selat Rupat	1993	9	0 (Missing)	0 (Missing)	SC/EB	0 (Missing)	4	Green	0 (Missing)	Dumai
8	722	Pelsu MPMT Sei Pakning	1994	8	0 (Missing)	0 (Missing)	A	0 (Missing)	6	Red/White V Strip	0 (Missing)	Dumai
9	723	Pelsu Sei Pakning	1994	8	1	0	A	0	4	Green	0	Dumai
10	729	Pelsu Sei Siak	1994	8	0	0	A	0	4	Red	0	Dumai
11	752	Pelsu P.Tengah Sei Siak	1995	7	0	0 (Missing)	A	0 (Missing)	4	Green	0	Dumai
12	862	Pelsu Batu Ampar	1990	12	0	1	EB	1	5	Red/White V Strip	0	Tg. Pinang
13	926	Pelsu MPMT Kuala Kijang	1996	6	0 (Missing)	0 (Missing)	A	0 (Missing)	6	Red/White V Strip	0 (Missing)	Dumai
14	1200	Sungai Jambi	1980	22	0	0	SC	0	6	Red/White V Strip	0	Palembang
15	1205	SungaiJambi (No 6)	1980	22	0	0 (Missing)	SC	0	6	Red	0	Palembang
16	1290	Katung	1976	26	0 (Missing)	0 (Missing)	SC	0 (Missing)	6	Red	0 (Missing)	Palembang
17	1350	Carat	1976	26	0 (Missing)	0 (Missing)	SC	0 (Missing)	6	Green	0 (Missing)	Palembang
18	1351	S. Palembang sebelah	1976	26	0 (Missing)	0 (Missing)	SC	0 (Missing)	6	Red	0 (Missing)	Palembang
19	1370	Tg Gede	1976	26	0 (Missing)	0 (Missing)	SC	0 (Missing)	6	Red	0 (Missing)	Palembang
20	1400	Selatan Payang	1976	26	0 (Missing)	0 (Missing)	SC	0 (Missing)	6	Red	0 (Missing)	Palembang
21	1712	Pulau Bulat	1987	15	0 (Missing)	0 (Missing)	SC	0 (Missing)	4	Red/White V Strip	0 (Missing)	Tg. Pinang
22	1721	Tanjung Priok	1993	9	0	0 (Missing)	SC	0	5	Yellow	0 (Damaged)	Tg. Pinang
23	1722	Tanjung Priok	1993	9	0	0 (Missing)	SC	0	5	Yellow	0 (Damaged)	Tg. Pinang
24	1824	Pelita Bahari	1990	12	0	0 (Missing)	SC	0	6	Green	0 (Broken)	Tg. Pinang
25	2030	MPMT Ambang Luar	1992	10	0	0	SC	0	6	Red/White V Strip	0	Pontianak
26	2131	Pelsu Pemangkat	1991	11	0	0 (Broken)	EB	0 (Broken)	4	Red/White V Strip	0 (Broken)	Pontianak
27	2134	Ma. Kuala Panjang	1995	7	0	0 (Broken)	A	0 (Broken)	7	Red/White V Strip	0 (Broken)	Pontianak
28	2988	Delta Doray	1970	32	0 (Missing)	0 (Missing)	SC	0 (Missing)	4	Black/Red H Band	0 (Missing)	Tg. Pinang
29	3119	Tegal	1990	12	1	1	SC	1	4	Red/White V Strip	0	Semarang
30	3140	Pelampung suar Pemalang	1990	12	1	1	SC	1	4	BY Hband	0	Semarang
31	3190	Pelampung suar	1995	7	0 (Missing)	0 (Missing)	SC	0 (Missing)	6	BY Hband	0 (Missing)	Semarang
32	3203	Semarang Tg. Mas (No 1)	1984	18	1	1	SC	1	4	Green	0	Semarang
33	3204	Semarang Tg. Mas	1985	17	0 (Sunken)	0 (Sunken)	EB	0 (Sunken)	4	Red	0 (Sunken)	Semarang
34	3205	Semarang Tg. Mas	1985	17	0 (Sunken)	0 (Sunken)	EB	0 (Sunken)	4	Green	0 (Sunken)	Semarang
35	3206	Semarang Tg. Mas	1985	17	0 (Sunken)	0 (Sunken)	EB	0 (Sunken)	4	Red	0	Semarang

Appendix 1.1.3.

Rehabilitation and Improvement of Visual Aids to Navigation in Master Plan (Light Buoy)

No.	No. (DSI)	Location	Establishment	Age	Operation Status	Condition of Lighting Apparatus	Energy	Condition of Power Supply	Range required	Color of Structure	Condition of Structure/ Buoy Body	ATN Office
36	3207	Semarang Tg. Mas	1985	17	0 (Sunken)	0 (Sunken)	EB	0 (Sunken)	4	Green	0	Semarang
37	3208	Semarang Tg. Mas (No.6)	1984	18	1	1	SC	1	4	Red	0	Semarang
38	3209	Semarang Tg. Mas	1984	18	1	1	SC	1	4	Yellow	0	Semarang
39	3260	Pelampung suar Tg. Emas	1984	18	1	1	SC	1	4	Red/White V Strip	0	Semarang
40	3291	Pelampung suar Pemalang	1988	14	0 (Sunken)	0 (Sunken)		0 (Sunken)	4	Black/Red H Band	0 (Sunken)	Semarang
41	4088	Pelsu N0.8 Alur Benoa	1983	19	0	0	SC/EB	0	4	Red	0	Benoa
42	4341	Pelsu Merah (Gs. Malang)	1985	17	0 (Sunken)	0 (Sunken)	SC	0 (Sunken)	4	Red	0 (Sunken)	Banjarmasin
43	4363	Sungai Barito (No.2)	1983	19	0 (Sunken)	0 (Sunken)	SC	0 (Sunken)	4	Red	0 (Sunken)	Banjarmasin
44	4364	Sungai Barito (No.3)	1994	8	0 (Sunken)	0 (Sunken)	SC	0 (Sunken)	4	Green	0 (Sunken)	Banjarmasin
45	4365	Sungai Barito (No.4)	1994	8	0 (Sunken)	0 (Sunken)	SC	0 (Sunken)	5	Red	0 (Sunken)	Banjarmasin
46	4367	Sungai Barito (No.6)	1994	8	0 (Missing)	0 (Missing)	SC	0 (Missing)	5	Red	0 (Missing)	Banjarmasin
47	4371	Pelsu No. 7 Sei Barito	*	----	0 (Missing)	0 (Missing)	SC	0 (Missing)	5	Green	0 (Missing)	Banjarmasin
48	4430	Sungai Kahayan	1980	22	0 (Missing)	0 (Missing)	SC	0 (Missing)	4	Red	0 (Missing)	Banjarmasin
49	4431	Sungai Kahayan (No.2)	1980	22	0 (Missing)	0 (Missing)	SC	0 (Missing)	4	Red	0 (Missing)	Banjarmasin
50	4754	Kutai River (Ma. Pegah)	1987	15	0	0	SC	0	4	Green	0	Samarinda
51	4756	Kutai River (Ma. Pegah)	1987	15	0	0	SC	0	4	Green	0	Samarinda
52	4870.1	S. Sanekuling	1987	15	0	0	SC	0	4	Red	0	Samarinda
53	5113	Pantoloan	1992	10	0	0	SC	0	4	Red	0 (Broken)	Bitung
54	5165	Sungai Berau	1976	26	0	0	SC	0	4	Red/White V Strip	0 (Missing)	Tarakan
55	6004	Merauke Sungai Merauke	1995	7	0 (Missing)	0	SC	0 (Broken)	6	Red	0	Merauke
56	6034	Aikawariver	1981	21	0	0	SC	0	6	Red	0	Sorong
57	6011	De Jong's Punt di muara	*	---	0	0	SC	0	6	Black	0	Merauke
58	6033	Sungai Flamingo	1981	21	0	0	A	0	5	Black	0	Merauke
59	6100	Pelsu S. Wasian	1996	6	0 (Missing)	0 (Missing)	A	0 (Missing)	4	Red/White V Strip	0 (Missing)	Sorong
60	6121	Ma. S. Kaikus	1977	25	0	0 (Missing)	SC	0 (Missing)	6	Red/White V Strip	0	Sorong
61	5761	Tenau Kupang	1970	32	0	0 (Missing)	SC	0 (Missing)	4		0	Kupng

Note: "0" and "1" of Operation Status show "Out of Services" and "In Services", respectively.
"0" of Lantern Condition, Power Supply Condition and Structure Condition shows being degrading, Damaged or Collapsed. "1" shows good.

Appendix 1.1.4.
Priority of Development of Visual Aids to Navigation in Master Plan (Lighthouse)

No.	DISNAV	Location	Land fall	Turning point	Dangers	Marine casualty	Marine traffic route	Sea-lane	Existing Port	SISTRANAS	Traffic demand	Total Score	Priority	Phase
1	Sabang	Uj. Mangki	0	5	5	0	5	0	0	0	1.25	16.250	89	5
2	Sabang	Uj. Pesangan	0	5	0	0	10	0	5	3	1.25	24.250	55	4
3	Belawan	Tg. Pertandangan	0	5	0	0	10	0	1	0	5	21.000	67	4
4	Tg.Pinang	Nunbing	0	5	5	5	10	0	0	0	5	30.000	27	3
5	Tg.Pinang	P. Panjang	10	5	10	0	10	10	1	0	5	51.000	2	1
6	Tg.Pinang	P.Seraya	0	5	5	0	10	2.5	1	0	5	28.500	32	3
7	Tg.Pinang	P.Timau	5	5	10	5	10	2.5	1	0	5	43.500	3	1
8	Tg.Pinang	Tg. Cakang	5	5	5	5	10	0	0	0	5	35.000	17	3
9	Tg.Pinang	Tg. Kemantan	2.5	5	10	5	5	2.5	2	0	5	37.000	12	2
10	Tg.Pinang	Tg. Sading	10	5	5	10	10	2.5	5	5	5	57.500	1	1
11	Tlk. Bayur	Uj. Talukasai	0	5	0	0	10	0	0	0	2.5	17.500	82	5
12	Tlk. Bayur	Uj. Tanjung	0	5	0	0	10	0	0	0	2.5	17.500	82	5
13	Palembang	Ayermasin	5	5	10	5	10	0	1	0	2.5	38.500	8	2
14	Palembang	P. Cebia	5	5	10	5	10	0	0	0	2.5	37.500	12	1
15	Palembang	Tg. Lesum	0	5	10	5	10	0	0	0	2.5	32.500	22	1
16	Palembang	Tg. Kait	5	5	5	5	10	0	1	0	2.5	33.500	19	3
17	Palembang	Uj. Batakarang	0	5	5	10	10	0	3	2	2.5	37.500	12	1
18	Tg. Priok	Sanding	5	5	5	0	10	0	0	0	2.5	27.500	39	3
19	Tg. Priok	Seblat	0	5	0	0	10	0	0	0	2.5	17.500	82	5
20	Tg. Priok	Tg. Gedeh	0	5	0	5	10	0	0	0	2.5	22.500	62	4
21	Tg. Priok	Tg. Losari	2.5	5	0	10	2.5	0	1	0	2.5	23.500	57	4
22	Tg. Priok	Tg. Sedari	0	5	0	5	10	0	1	0	2.5	23.500	57	4
23	Tg. Priok	Uj. Genteng	10	0	10	5	10	0	1	0	2.5	38.500	8	2
24	Tg. Priok	Uj. Tk. Punggur	2.5	5	0	5	10	0	3	2	2.5	30.000	27	3
25	Semarang	Tg. Pemalang	0	5	0	10	2.5	0	2	1	2.5	23.000	57	4
26	Surabaya	Memburit	5	5	10	5	10	0	1	0	5	41.000	4	1
27	Surabaya	Tg. Sbkah	5	5	5	0	10	0	0	0	5	30.000	27	3
28	Benoa	P. Menjangan	5	5	10	5	10	0	2	2	2.5	41.500	4	1
29	Benoa	Marba	5	5	0	0	10	5	1	0	2.5	28.500	32	3
30	Benoa	Tg. Amat	5	5	5	0	2.5	0	1	0	2.5	21.000	67	4
31	Benoa	Tg. Lessek	0	5	0	10	2.5	0	0	0	2.5	20.000	74	4
32	Benoa	Tg. Tekurenan	5	5	0	10	10	0	0	0	2.5	32.500	22	2
33	Pontianak	Tg. Bangka	0	5	0	10	10	0	0	0	2.5	27.500	39	3
34	Banjarmasin	Tg. Dewa	2.5	5	10	10	5	0	2	1	5	40.500	7	3
35	Banjarmasin	Tg. Selaka	0	5	0	0	10	0	0	0	5	20.000	74	4
36	Samarinda	Tg. Bayur	0	5	10	0	5	0	0	0	5	25.000	51	4
37	Samarinda	Tg. Jumalai	5	0	5	5	10	0	5	3	5	38.000	8	3
38	Samarinda	Tg. Perupu	0	5	0	0	5	0	1	0	5	16.000	90	5
39	Samarinda	Tg.Aru	2.5	5	10	5	10	0	1	0	5	38.500	8	2
40	Tarakan	Ma. Pekin	2.5	0	0	0	5	0	2	2	5	16.500	88	5
41	Manado/Bitung	Buang Buang	5	5	5	0	10	0	1	0	5	31.000	24	3
42	Manado/Bitung	P. Bentenan	5	5	0	0	5	0	2	2	5	24.000	55	4
43	Manado/Bitung	P. Puludua	0	5	5	0	5	0	0	0	5	20.000	74	4
44	Manado/Bitung	P.Makalehi	0	5	10	0	5	0	1	0	5	26.000	47	3
45	Manado/Bitung	P.Sago	0	5	10	0	2.5	0	0	0	5	22.500	62	4
46	Manado/Bitung	Tg. Api	2.5	0	5	10	5	0	1	0	5	28.500	32	3
47	Manado/Bitung	Tg. Dominango	0	5	0	0	5	0	1	0	5	16.000	90	5
48	Manado/Bitung	Tg.TALABU	0	5	0	0	10	0	0	0	5	20.000	74	4
49	Kendari	P. Sainoa	5	5	5	0	10	0	0	0	5	30.000	27	3
50	Kendari	P.Anano	5	5	10	0	10	0	0	0	5	35.000	17	2
51	Kendari	Tg. Goram	0	5	0	0	10	0	1	0	5	21.000	67	4
52	Makassar	P. Sagara	0	5	10	10	5	0	1	0	5	36.000	15	3

Appendix 1.1.4.
Priority of Development of Visual Aids to Navigation in Master Plan (Lighthouse)

No.	DISNAV	Location	Land fall	Turning point	Dangers	Marine casualty	Marine traffic route	Sea-lane	Existing Port	SISTRANAS	Traffic demand	Total Score	Priority	Phase
52	Makassar	P. Sagara	0	5	10	10	5	0	1	0	5	36.000	15	3
53	Makassar	Tg. Bodjo	2.5	0	5	5	10	0	3	1	5	31.500	24	3
54	Kupang	P. Raja	0	5	0	5	10	0	1	0	5	26.000	47	3
55	Kupang	P.Nusa Ende	0	5	5	0	10	2.5	2	1	0	25.500	51	4
56	Kupang	Seraja Besar	5	5	10	5	10	0	1	0	5	41.000	4	2
57	Kupang	Tg. Boda	0	5	5	0	10	2.5	0	0	5	27.500	39	3
58	Kupang	Tg. Mas	5	5	0	0	10	2.5	1	0	5	28.500	32	3
59	Kupang	Tg. Muna	0	5	10	0	10	0	2	1	5	33.000	19	2
60	Kupang	Tg. Kopondai	0	5	0	0	10	0	1	0	5	21.000	67	4
61	Ambon	Banda Besar	2.5	5	5	0	10	0	1	0	5	28.500	32	3
62	Ambon	Batusambo	0	5	5	0	2.5	0	1	0	5	18.500	78	4
63	Ambon	Manuwui	0	5	5	0	2.5	0	1	0	5	18.500	78	4
64	Ambon	P. Ambelau	5	5	0	0	5	2.5	0	0	5	22.500	62	4
65	Ambon	P. Ceramrei	5	0	5	0	10	0	1	0	5	26.000	47	3
66	Ambon	P. Damar	0	5	0	0	10	0	1	0	5	21.000	67	4
67	Ambon	P. Nusalaut	5	5	0	0	2.5	0	1	0	5	18.500	78	4
68	Ambon	P.P. Maisel	0	5	0	0	10	2.5	0	0	5	22.500	62	4
69	Ambon	P.Pombo tinggi	0	5	5	0	10	0	1	0	5	26.000	47	4
70	Ambon	Sarangburung	5	5	0	0	10	2.5	0	0	5	27.500	39	3
71	Ambon	Tg. Hatanua	5	5	5	0	10	0	0	0	5	30.000	27	3
72	Ambon	Tg. Libobo	0	5	5	0	2.5	0	0	0	5	17.500	82	5
73	Ambon	Tg. Namaa	0	5	10	0	2.5	0	0	0	5	22.500	62	4
74	Ambon	Tg. Ngolopopo	5	0	5	0	10	0	0	0	5	25.000	51	4
75	Ambon	Tg. Weduar	10	5	5	5	2.5	2.5	1	0	5	36.000	15	2
76	Ambon	Tg.Sial	0	5	5	5	10	0	1	0	5	31.000	24	3
77	Ambon	Tg.Watina	5	5	0	0	5	2.5	1	0	5	23.500	57	4
78	Ambon	Walwat tinggi	10	5	0	0	2.5	10	1	0	5	33.500	19	2
79	Jayapura	P. Anus	0	5	5	5	10	0	1	0	2.5	28.500	32	3
80	Jayapura	P. Miosnum	0	5	5	0	5	0	5	3	2.5	25.500	51	4
81	Jayapura	Tg. Mandundi	0	5	10	0	10	0	1	0	2.5	28.500	32	3
82	Sorong	P. Daram	0	5	10	0	10	0	0	0	2.5	27.500	39	3
83	Sorong	P. Tumbutumbu	0	5	5	0	10	0	1	0	2.5	23.500	57	4
84	Sorong	P.Ayu	2.5	0	10	0	2.5	0	1	0	2.5	18.500	78	5
85	Sorong	Tg. Namaripi	0	5	0	0	10	0	0	0	2.5	17.500	82	5
86	Sorong	Tg. Ngoni	0	5	10	0	10	0	0	0	2.5	27.500	39	3
87	Sorong	Tg. Papisoi	5	5	5	0	10	0	0	0	2.5	27.500	39	3
88	Sorong	Tg. Saweba	0	5	0	0	10	0	2	2	2.5	21.500	67	4
89	Sorong	Tg. Wesio	0	5	0	0	10	0	0	0	2.5	17.500	82	5
90	Sorong	Tg.OPENTA	0	5	10	0	10	0	0	0	2.5	27.500	39	3
91	Sorong	Wayeteri	2.5	0	5	0	10	0	1	0	2.5	21.000	67	4

Appendix 1.1.5.
Priority of Development of Visual Aids to Navigation in Master Plan
(Light Beacon)

No.	DISNAV	Location	Land fall	Turnin g point	Danger s	Marine casualt y	Marine traffic route	Sea-lane	Existing Port	SIST RANA S	Traffic demand	Total Score	Priority	Phase
1	Sabang	Kr. Biawak	0	5	10	0	5	0	0	0	1.25	21.25	147	3
2	Sabang	Kr.Gatui	2.5	0	0	0	2.5	10	0	3	1.25	19.25	170	4
3	Sabang	Lhok Seumawe	0	0	0	0	2.5	10	0	3	1.25	16.75	218	4
4	Sabang	P.Batu.Belayar	0	5	0	0	2.5	0	0	0	1.25	8.75	305	5
5	Sabang	P.Ina	0	5	0	0	2.5	0	0	0	1.25	8.75	305	5
6	Sabang	P.Lakon	0	5	0	0	2.5	0	0	0	1.25	8.75	305	5
7	Sabang	P.Rubiah	10	5	0	0	5	2.5	0	2	1.25	25.75	100	3
8	Sabang	Sinabang	10	5	0	0	2.5	0	0	0	1.25	18.75	172	4
9	Sabang	Tg. Sabin	0	5	0	0	2.5	0	0	0	1.25	8.75	305	5
10	Sabang	Tg.Ketaping	0	5	0	0	5	0	0	0	1.25	11.25	275	5
11	Sabang	Uj.Lampuyang	0	5	5	0	5	0	0	0	1.25	16.25	218	4
12	Sabang	Uj.Meuduroe	0	5	0	5	10	0	0	2	1.25	23.25	124	3
13	Belawan	Sei. Berombang	2.5	0	0	0	2.5	0	0	0	5	10	285	5
14	Belawan	Sei. Berombang	2.5	0	0	0	10	0	0	0	5	17.5	183	4
15	Belawan	Tg.Tiram	0	0	0	10	10	2.5	0	0	5	27.5	69	3
16	Sibolga	Amboina	0	5	10	0	2.5	0	0	0	5	22.5	125	3
17	Sibolga	Kr.Karang	0	5	10	0	10	0	0	0	5	30	53	2
18	Sibolga	Kr.Kasi	0	5	0	0	2.5	0	0	0	5	12.5	259	5
19	Sibolga	Kr.Lago	0	5	10	0	10	0	1	0	5	31	47	2
20	Sibolga	Kr.Tonga	0	5	10	0	10	0	1	0	5	31	47	2
21	Sibolga	P.Jawijawi	0	5	10	0	2.5	0	0	0	5	22.5	125	3
22	Sibolga	P.Sarudut	0	0	5	5	10	5	0	2	5	32	44	2
23	Sibolga	P.Wunge	10	5	0	0	2.5	0	0	0	5	22.5	125	3
24	Sibolga	Pel.Sibolga	10	5	0	0	10	0	0	0	5	30	53	2
25	Sibolga	Pel.Sikara-kara	0	0	0	0	10	0	0	0	5	15	231	4
26	Sibolga	Tg.Bai	0	5	10	0	5	0	0	0	5	25	102	3
27	Sibolga	Tg.Ikhunene	10	5	0	0	2.5	0	0	0	5	22.5	125	3
28	Sibolga	Tg.Lambaru	0	0	0	10	10	0	0	0	5	25	102	3
29	Sibolga	Tg.Siginigini	0	5	0	0	5	0	1	0	5	16	220	4
30	Sibolga	Tg.Toyolawa	0	5	0	0	10	0	0	0	5	20	155	4
31	Sibolga	Ug. Batu Panjang	2.5	0	0	0	10	0	0	0	5	17.5	183	4
32	Sibolga	Ug.Teduihu	0	0	0	0	10	0	0	0	5	15	231	4
33	Dumai	Tg. Sinaboi	0	5	0	0	10	5	0	0	5	25	102	3
34	Dumai	Gs.Mumbul	2.5	5	5	10	10	5	0	0	5	42.5	12	1
35	Dumai	Pel.Kuala Enok	2.5	5	10	5	10	0	0	0	5	37.5	23	1
36	Dumai	Pel.Kuala Enok	2.5	5	10	5	10	0	0	0	5	37.5	23	1
37	Dumai	Pel.Kuala Enok	2.5	5	10	5	10	0	0	0	5	37.5	23	1
38	Dumai	Selatan P.Tengah	0	5	5	10	10	0	3	0	5	38	20	1
39	Dumai	Tg.Layang	0	5	5	10	10	0	3	0	5	38	20	1
40	Dumai	Utara P.Tengah	0	5	5	10	10	0	3	0	5	38	20	1
41	Tg.Pinang	P. Ritan	10	5	10	5	10	0	0	0	5	45	9	1
42	Tg.Pinang	Batu Berlayar	5	5	2.5	0	2.5	5	0	0	5	25	102	3
43	Tg.Pinang	Karang Singa	0	0	0	0	5	0	0	0	5	10	285	5
44	Tg.Pinang	Kr.Jackson	10	5	0	0	2.5	5	0	0	5	27.5	69	3
45	Tg.Pinang	Kr.Nginang	0	5	10	10	10	0	5	0	5	45	9	1
46	Tg.Pinang	LAP.1955(2m)	0	5	0	0	10	5	0	0	5	25	102	3
47	Tg.Pinang	Lap.1980	10	0	0	0	10	5	0	0	5	30	53	2
48	Tg.Pinang	P. Batuberlayar	0	5	10	5	10	0	0	0	5	35	31	1
49	Tg.Pinang	P.Selanga	0	5	10	5	10	0	0	0	5	35	31	1
50	Tg.Pinang	P.Tokong Kemudi	0	5	0	0	5	0	0	0	5	15	231	4
51	Tg.Pinang	Pel. Letung	10	5	5	0	2.5	0	1	0	5	28.5	63	3

Appendix 1.1.5.

Priority of Development of Visual Aids to Navigation in Maste r Plan (Light Beacon)

No.	DISNAV	Location	Land fall	Turnin g point	Danger s	Marine casualt y	Marine traffic route	Sea-lane	Existing Port	SIST RANA S	Traffic demand	Total Score	Priority	Phase
51	Tg.Pinang	Pel. Letung	10	5	5	0	2.5	0	1	0	5	28.5	63	3
52	Tg.Pinang	Pel.Midai	10	5	10	0	10	5	1	0	5	46	4	1
53	Tg.Pinang	Pel.Midai	10	5	10	0	10	5	1	0	5	46	4	1
54	Tg.Pinang	Pel.Midai	10	5	10	0	10	5	1	0	5	46	4	1
55	Tg.Pinang	Pl.Selanga	0	0	5	0	2.5	0	1	0	5	13.5	250	4
56	Tg.Pinang	Sel.Kijang	0	0	5	5	10	0	1	0	5	26	94	3
57	Tg.Pinang	Sel.Kijang	0	0	5	5	10	0	1	0	5	26	94	3
58	Tg.Pinang	P. Senggakang	2.5	5	10	5	10	0	5	5	5	47.5	2	1
59	Tg.Pinang	P. Penyengat	2.5	5	10	5	10	0	5	5	5	47.5	2	1
60	Tg.Pinang	Tg.Gabi	0	5	5	0	10	0	1	0	5	26	94	3
61	Tlk. Bayur	Kr. P. Langaraik	0	5	10	0	10	0	0	0	2.5	27.5	69	3
62	Tlk. Bayur	Kr. Pincuran Butun	0	5	10	0	10	0	2	2	2.5	31.5	46	2
63	Tlk. Bayur	Kr. Sijau-Jau	0	5	0	0	10	0	0	0	2.5	17.5	183	4
64	Tlk. Bayur	Kr. Stort	0	5	10	0	10	0	0	0	2.5	27.5	69	3
65	Tlk. Bayur	P. Laut	0	5	10	0	10	0	0	3	2.5	30.5	50	2
66	Tlk. Bayur	Tg. Simatobe	0	0	0	0	10	0	1	0	2.5	13.5	250	5
67	Palembang	Kr. Haji	2.5	5	5	10	10	0	3	2	5	42.5	12	1
68	Palembang	Ma. Kuala Tungkal	2.5	5	10	5	10	0	0	0	5	37.5	23	1
69	Palembang	Ma. Kuala Tungkal	2.5	5	10	5	10	0	0	0	5	37.5	23	1
70	Palembang	Ma.Ka. Berbak	0	0	0	0	5	0	1	0	2.5	8.5	309	5
71	Palembang	P.Gaspar	0	5	10	0	10	0	0	0	2.5	27.5	69	3
72	Palembang	P.Lalang	2.5	0	0	0	5	0	0	0	2.5	10	285	5
73	Palembang	P.tokong Kembang	5	5	2.5	0	5	0	0	0	2.5	20	155	4
74	Palembang	Selat Nando	2.5	0	10	5	10	0	0	3	5	35.5	23	1
75	Palembang	Tg. Terentang	2.5	5	10	5	10	0	0	0	5	37.5	23	1
76	Palembang	Tg.Buyut	2.5	0	0	10	5	0	0	0	2.5	20	155	4
77	Tg. Priok	Tg. Batu Kebutjung		5	5		10	0	0	0	2.5	22.5	125	3
78	Tg. Priok	Bayangan Air	2.5	5	5	5	10	5	0	0	2.5	35	31	2
79	Tg. Priok	Gs. Tohorjantan	0	5	10	10	10	0	0	0	2.5	37.5	23	2
80	Tg. Priok	Kr. Gundul	2.5	5	10	5	10	0	0	0	2.5	35	31	1
81	Tg. Priok	Kr. Kerbau	0	5	10	10	10	2.5	5	0	2.5	45	9	1
82	Tg. Priok	Indramayu	0	0	0	0	5	0	3	3	2.5	13.5	250	4
83	Tg. Priok	Cirebon	0	0	0	5	2.5	0	0	0	2.5	10	285	5
84	Tg. Priok	Kr. Rakit Utara	5	5	0	5	10	0	0	0	2.5	27.5	69	3
85	Tg. Priok	P.Selanga	2.5	0	0	0	5	0	0	0	2.5	10	285	5
86	Tg. Priok	Tg. Selokan	2.5	5	0	10	5	2.5	0	0	2.5	27.5	69	3
87	Tg. Priok	Tg.Karawang	2.5	5	10	10	10	0	0	0	2.5	40	16	1
88	Semarang	Alur Pel. Karimun Jawa	2.5	5	10	5	10	0	0	0	2.5	35	31	1
89	Semarang	Alur Pel. Karimun Jawa	2.5	5	10	5	10	0	0	0	2.5	35	31	1
90	Semarang	Alur Pel. Karimun Jawa	2.5	5	10	5	10	0	0	0	2.5	35	31	1
91	Semarang	Kr Seliro	5	0	5	0	2.5	0	0	0	2.5	15	231	4
92	Semarang	Kr. Masaran	2.5	0	5	0	2.5	0	0	0	2.5	12.5	259	5
93	Semarang	Kr. Sverre	5	5	0	5	10	0	0	0	2.5	27.5	69	3
94	Semarang	Kr. Wen-wen	2.5	5	5	0	2.5	0	0	0	2.5	17.5	183	4
95	Semarang	Pel. Rembang	2.5	0	5	0	2.5	0	0	0	2.5	12.5	259	5
96	Cilacap	Baron	10	5	0	5	2.5	0	0	0	2.5	25	102	3
97	Cilacap	Tg. Sunanggu	2.5	5	5	0	2.5	2.5	0	0	2.5	20	155	4
98	Cilacap	Tg. Watukarang	2.5	0	0	10	2.5	0	0	0	2.5	17.5	183	4
99	Surabaya	Gs. Balam	5	5	2.5	0	5	0	0	0	5	22.5	125	3
100	Surabaya	GS. Castor	2.5	5	10	10	10	0	5	5	5	52.5	1	1
101	Surabaya	P. Gililawak	10	5	0	0	10	0	0	2	5	32	44	2

Appendix 1.1.5.
Priority of Development of Visual Aids to Navigation in Master Plan (Light Beacon)

No.	DISNAV	Location	Land fall	Turning point	Dangers	Marine casualty	Marine traffic route	Sea-lane	Existing Port	SISTRANAS	Traffic demand	Total Score	Priority	Phase
101	Surabaya	P. Gililawak	10	5	0	0	10	0	0	2	5	32	44	2
102	Surabaya	P. Giliyang	0	5	2.5	10	10	0	0	0	5	32.5	41	2
103	Surabaya	P. Kambing	10	5	0	0	10	0	0	0	5	30	53	2
104	Surabaya	P.Sepekan	5	5	5	10	10	2.5	0	0	5	42.5	12	1
105	Surabaya	Pel. Kangean	10	5	0	0	5	0	0	0	5	25	102	3
106	Benoa	P. Belang	0	0	5	0	5	0	1	0	2.5	13.5	250	4
107	Benoa	Tg. Pasir	0	0	5	5	10	0	1	2	2.5	25.5	101	3
108	Benoa	Tg.Kramitan	0	0	5	5	5	10	1	0	2.5	28.5	63	3
109	Pontianak	Kr.Co	0	0	0	0	2.5	2.5	0	2	2.5	9.5	303	5
110	Pontianak	Ma. Kendawangan	0	5	5	0	2.5	2.5	0	0	2.5	17.5	183	4
111	Pontianak	Ma. Kendawangan	0	5	5	0	2.5	2.5	0	0	2.5	17.5	183	4
112	Pontianak	Ma. Kendawangan	2.5	5	0	0	2.5	2.5	0	0	2.5	15	231	4
113	Pontianak	Ma. Kendawangan	2.5	5	0	0	2.5	0	0	0	2.5	12.5	259	5
114	Banjarmasin	Kp.Baru	0	0	5	10	5	0	1	0	5	26	94	3
115	Banjarmasin	Kp.Baru	0	0	5	0	10	0	1	0	5	21	148	3
116	Banjarmasin	Ma. S. Barito	2.5	5	0	10	5	0	0	3	5	30.5	50	2
117	Banjarmasin	Ma. S. Barito	2.5	5	0	10	5	0	0	3	5	30.5	50	2
118	Banjarmasin	Ma. S. Kahayan	0	0	0	0	2.5	0	1	0	5	8.5	309	5
119	Banjarmasin	Ma. S. Kahayan	0	0	0	0	2.5	0	1	0	5	8.5	309	5
120	Banjarmasin	P. KadaPangan	0	5	2.5	5	10	0	0	0	5	27.5	69	3
121	Banjarmasin	P. Pamelika	0	5	2.5	5	10	0	0	0	5	27.5	69	3
122	Banjarmasin	Sei.Kahayan no.3	0	5	5	0	2.5	0	1	0	5	18.5	173	4
123	Banjarmasin	Sei.Kahayan no.4	2.5	5	0	0	2.5	0	1	0	5	16	220	4
124	Banjarmasin	Sei.Kahayan no.6	2.5	5	0	0	2.5	0	1	0	5	16	220	4
125	Banjarmasin	Sei.Kahayan no.7	0	0	0	0	2.5	0	1	0	5	8.5	309	5
126	Banjarmasin	Sei.Mentaya(green)	2.5	0	0	5	10	0	0	0	5	22.5	125	3
127	Banjarmasin	Tg. Burung	0	0	0	10	10	0	0	3	5	28	68	3
128	Samarinda	GsRending	2.5	0	2.5	5	5	0	1	0	5	21	148	3
129	Samarinda	Kr. Grogot	2.5	5	0	0	10	0	0	0	5	22.5	125	3
130	Samarinda	Kr.Unarang	2.5	5	5	0	10	0	5	0	5	32.5	41	2
131	Samarinda	Muara Berau	2.5	5	2.5	10	10	0	1	3	5	39	19	2
132	Tarakan	Kr.Adat	2.5	5	0	0	10	0	0	0	5	22.5	125	3
133	Tarakan	Tg.Buasin	2.5	5	0	0	10	0	0	0	5	22.5	125	3
134	Tarakan	Tg.Keris	0	5	5	0	10	0	0	2	5	27	93	3
135	Tarakan	Tg.Sadau	0	0	5	0	10	0	0	2	5	22	146	3
136	Manado/Bitung	Batu tengah	0	0	2.5	0	10	0	1	0	5	18.5	173	4
137	Manado/Bitung	Karang Vesuvius	0	5	10	0	5	0	0	0	5	25	102	3
138	Manado/Bitung	Kolonedale	0	0	0	0	10	0	1	0	5	16	220	4
139	Manado/Bitung	Kr. Jasina	5	5	10	0	2.5	0	0	0	5	27.5	69	3
140	Manado/Bitung	Kr. Teluk Mundung	0	5	0	0	5	0	0	0	5	15	231	4
141	Manado/Bitung	Kr. Tg. Tobayagan	2.5	0	0	0	5	0	0	0	5	12.5	259	5
142	Manado/Bitung	Mentarawu(P.Nain)	5	5	0	0	10	0	0	0	5	25	102	3
143	Manado/Bitung	Napu Arampua	10	5	10	0	2.5	10	1	0	5	43.5	12	1
144	Manado/Bitung	P. Biaro	0	5	2.5	0	10	0	0	0	5	22.5	125	3
145	Manado/Bitung	P. Saaru/Napu Mbalu	0	5	5	0	2.5	0	0	0	5	17.5	183	4
146	Manado/Bitung	P.Azasal	2.5	0	5	0	10	0	0	0	5	22.5	125	3
147	Manado/Bitung	P.Nitu	0	5	2.5	0	10	0	0	0	5	22.5	125	3
148	Manado/Bitung	P.Potil Kecil	0	5	5	0	10	0	0	0	5	25	102	3
149	Manado/Bitung	P.Sanggeluhang	10	5	0	0	10	0	0	0	5	30	53	2
150	Manado/Bitung	P.Tempau	0	5	0	0	10	0	0	0	5	20	155	4
151	Manado/Bitung	P.Tifore	5	5	0	0	2.5	2.5	0	0	5	20	155	4

Appendix 1.1.5.
Priority of Development of Visual Aids to Navigation in Master Plan
(Light Beacon)

No.	DISNAV	Location	Land fall	Turning point	Dangers	Marine casualty	Marine traffic route	Sea-lane	Existing Port	SISTRANAS	Traffic demand	Total Score	Priority	Phase
151	Manado/Bitung	P.Tifore	5	5	0	0	2.5	2.5	0	0	5	20	155	4
152	Manado/Bitung	Pel.Banggai	0	0	0	0	10	0	0	0	5	15	231	4
153	Manado/Bitung	Pel. Bunta	0	0	0	0	2.5	0	1	0	5	8.5	309	5
154	Manado/Bitung	Pel.Ampana	0	5	2.5	0	2.5	0	0	0	5	15	231	4
155	Manado/Bitung	Pel.Bitung	2.5	0	5	0	10	0	1	5	5	28.5	63	3
156	Manado/Bitung	Awit	10	5	10	10	2.5	2.5	1	0	5	46	4	1
157	Manado/Bitung	Pel.Paleleh	0	0	5	0	2.5	0	0	0	5	12.5	259	5
158	Manado/Bitung	Pel.Paleleh	0	0	5	0	2.5	0	0	0	5	12.5	259	5
159	Manado/Bitung	Pel.Tamako	10	5	10	5	10	0	1	0	5	46	4	1
160	Manado/Bitung	PelAmpana	0	0	0	0	5	0	1	0	5	11	276	5
161	Manado/Bitung	Sanggelukang	5	5	5	0	10	0	0	0	5	30	53	2
162	Manado/Bitung	Telk Boraag uki	2.5	0	0	0	2.5	0	0	0	5	10	285	5
163	Manado/Bitung	Tg. Panango	0	0	0	0	5	0	1	0	5	11	276	5
164	Manado/Bitung	Tg. Ibaiba	10	5	0	0	2.5	0	0	0	5	22.5	125	3
165	Manado/Bitung	Tg. Liku	0	5	5	0	10	0	0	0	5	25	102	3
166	Manado/Bitung	Tg. Puisan	0	5	5	0	2.5	0	0	0	5	17.5	183	4
167	Manado/Bitung	Tg. Tombaliatu	0	0	0	0	5	0	0	0	5	10	285	5
168	Manado/Bitung	Tg. Papalanpungan	5	5	10	10	2.5	2.5	0	0	5	40	16	1
169	Manado/Bitung	Tg.Pamali	0	5	0	0	10	0	0	0	5	20	155	4
170	Manado/Bitung	Tg.Pamali	0	5	0	0	2.5	0	0	0	5	12.5	259	5
171	Kendari	Bungku Toko	2.5	0	5	0	5	0	0	3	5	20.5	154	3
172	Kendari	Gs. Saponda Selatan	2.5	5	5	0	10	0	0	0	5	27.5	69	3
173	Kendari	Gs. Selatan	5	5	2.5	0	10	0	0	0	5	27.5	69	3
174	Kendari	Gs. Utara	5	5	2.5	0	10	0	0	0	5	27.5	69	3
175	Kendari	Kr. Barat Langara Bugis	0	0	0	0	5	0	0	0	5	10	285	5
176	Kendari	Kr. Barat P. Maloan	5	5	2.5	0	2.5	0	0	0	5	20	155	3
177	Kendari	Kr. Bokori	0	0	0	0	5	0	0	3	5	13	258	5
178	Kendari	Kr. Dungi	0	0	10	0	2.5	0	0	0	5	17.5	183	4
179	Kendari	Kr. Generaal Pel	5	5	0	0	10	0	0	0	5	25	102	3
180	Kendari	Kr. Langara Bugis	0	0	0	0	5	0	0	0	5	10	285	5
181	Kendari	Kr. Lingoro	5	5	5	10	5	0	0	0	5	35	31	2
182	Kendari	Kr. P. Basa	5	5	0	0	2.5	0	0	0	5	17.5	183	4
183	Kendari	Kr. P. Randa	0	5	5	0	10	0	1	0	5	26	94	3
184	Kendari	Kr. Pel. Raha	0	0	5	0	10	0	1	0	5	21	148	3
185	Kendari	Kr. Pomalaa	2.5	5	0	0	2.5	0	0	0	5	15	231	4
186	Kendari	Kr. Raha	0	0	5	0	0	0	1	0	5	11	276	5
187	Kendari	Kr. Rintang Selatan	2.5	5	2.5	0	2.5	0	0	0	5	17.5	183	4
188	Kendari	Kr. Rosa Marie	2.5	5	0	5	2.5	0	0	0	5	20	155	3
189	Kendari	Kr. Runduma	5	5	2.5	0	10	0	0	0	5	27.5	69	3
190	Kendari	Kr. Selat Masiri	5	5	10	0	10	0	0	0	5	35	31	2
191	Kendari	Kr. Selatan	0	5	10	5	2.5	0	0	0	5	27.5	69	3
192	Kendari	Kr. Selatan Kaledupa	5	5	0	0	2.5	0	0	0	5	17.5	183	4
193	Kendari	Kr. Selatan Kapota	5	5	0	0	10	0	0	0	5	25	102	3
194	Kendari	Kr. Teluk Lemobajo	0	0	0	0	5	0	0	0	5	10	285	5
195	Kendari	Kr. Tg. Barat Laut Kaledupa	0	0	0	0	10	0	0	0	5	15	231	4
196	Kendari	Kr. Timur (Oneete)	2.5	5	2.5	0	2.5	0	0	0	5	17.5	183	4
197	Kendari	Kr. Timur Batumarimpih	0	0	0	0	2.5	0	1	0	5	8.5	309	5
198	Kendari	Kr. Timur Tg. Wawobatu	0	5	0	0	5	0	0	0	5	15	231	4
199	Kendari	Kr. Utara Kaledupa	0	5	10	0	10	0	0	0	5	30	53	2
200	Kendari	Kr. Utara Kapota	0	5	10	0	10	0	0	0	5	30	53	2
201	Kendari	Kr. Utara P. Papado	0	0	5	0	2.5	0	0	0	5	12.5	259	5

Appendix 1.1.5.
Priority of Development of Visual Aids to Navigation in Master Plan
(Light Beacon)

No.	DISNAV	Location	Land fall	Turning point	Dangers	Marine casualty	Marine traffic route	Sea-lane	Existing Port	SIST RANAS	Traffic demand	Total Score	Priority	Phase
201	Kendari	Kr. Utara P. Papado	0	0	5	0	2.5	0	0	0	5	12.5	259	5
202	Kendari	Kr. Utara Sel. Wowonii	2.5	0	5	0	10	0	0	0	5	22.5	125	3
203	Kendari	Kr. Utara Tg. Teipa	0	5	0	0	2.5	0	0	0	5	12.5	259	5
204	Kendari	Kr.P.Hoga	0	5	10	0	5	0	0	0	5	25	102	3
205	Kendari	Kr.Utara Lapuko	0	0	0	0	5	0	0	0	5	10	285	5
206	Kendari	P. Damalawa Kcl.	0	0	5	0	2.5	0	0	0	5	12.5	259	5
207	Kendari	P. Sangurabangi	0	0	0	10	10	0	0	0	5	25	102	3
208	Kendari	P. Togomongolo	5	5	10	0	10	0	0	0	5	35	40	2
209	Kendari	Pel. Lasalimu	2.5	0	0	0	10	0	0	0	5	17.5	183	4
210	Kendari	Pel. Lasalimu	0	0	0	0	5	0	0	0	5	10	285	5
211	Kendari	Pel. Mandiodo	0	0	0	0	2.5	0	1	0	5	8.5	309	5
212	Kendari	Pel. Mawasangka	0	0	0	0	10	0	0	0	5	15	231	4
213	Kendari	Tg. Barat Papado	0	0	2.5	0	2.5	0	0	0	5	10	285	5
214	Kendari	Tg. Batu Kala	2.5	0	0	0	2.5	0	0	0	5	10	285	5
215	Kendari	Tg. Batu Manu	0	0	0	0	10	0	0	0	5	15	231	4
216	Kendari	Tg. Kalandria	0	0	5	0	10	0	0	0	5	20	155	4
217	Makassar	Jampea	10	5	2.5	0	10	0	0	0	5	32.5	41	2
218	Makassar	Jampea	5	5	2.5	0	10	0	1	0	5	28.5	63	3
219	Makassar	Kr. Melintang	0	0	0	10	2.5	0	0	0	5	17.5	183	4
220	Makassar	Kr. P. P. Takabonerate	5	5	2.5	0	10	0	0	0	5	27.5	69	3
221	Makassar	Kr. Taka Rangkap	0	5	5	0	10	0	1	0	5	26	94	3
222	Makassar	Kr. Ug. Pepe	2.5	0	0	0	10	0	0	0	5	17.5	183	4
223	Makassar	Kr.Laubang	0	0	0	0	10	0	3	0	5	18	182	4
224	Makassar	Kr.P.Saujung	10	5	10	0	10	0	0	0	5	40	16	2
225	Makassar	Kr.Tete	0	5	0	0	10	0	0	0	5	20	155	3
226	Makassar	Kr.Tg.Tonrangang	2.5	0	0	0	10	0	0	0	5	17.5	183	4
227	Makassar	P. Karompacadi	5	5	2.5	0	10	0	1	0	5	28.5	63	3
228	Makassar	P. Lamuruang	5	5	2.5	0	5	0	0	0	5	22.5	125	3
229	Makassar	P. Libukang	2.5	0	0	0	10	0	1	0	5	18.5	173	4
230	Makassar	P. Makaranangana	5	5	2.5	0	10	0	0	0	5	27.5	69	3
231	Makassar	P. Marasende	5	5	2.5	0	10	2.5	1	0	5	31	47	2
232	Makassar	P. MnuKang	5	5	2.5	0	10	0	0	0	5	27.5	69	3
233	Makassar	P. Sambarjaga	5	5	2.5	0	10	0	0	0	5	27.5	69	3
234	Makassar	P. Tampaang	5	5	2.5	0	10	0	0	0	5	27.5	69	3
235	Makassar	Pel.Awerange	0	0	5	0	10	0	1	0	5	21	148	3
236	Makassar	Pel.Palopa	0	0	0	0	5	0	1	0	5	11	276	5
237	Makassar	Pel.Serayar	5	5	10	0	5	0	0	0	5	30	53	3
238	Makassar	Polewali	2.5	5	0	0	2.5	0	1	0	5	16	220	4
239	Makassar	Polewali	2.5	5	0	0	2.5	0	1	0	5	16	220	4
240	Makassar	Tg. Appatana	5	5	5	0	10	0	0	0	5	30	53	2
241	Makassar	Tg. Labua	0	0	0	0	5	0	0	0	5	10	285	5
242	Makassar	Tg. Salangketo	0	5	0	0	2.5	0	0	0	5	12.5	259	5
243	Makassar	Tg. Sarupo	0	0	0	0	2.5	0	1	0	5	8.5	309	5
244	Makassar	Tg. Suramana	0	0	0	0	10	0	0	0	5	15	231	4
245	Kupang	Alur Pelab. Balauring	0	0	0	0	2.5	0	1	0	5	8.5	309	5
246	Kupang	Alur Pelab. Balauring	0	0	0	0	10	0	1	0	5	16	220	4
247	Kupang	Balauring	0	0	0	0	2.5	0	1	0	5	8.5	309	5
248	Kupang	Barat daya Pade	0	0	0	0	10	0	1	0	5	16	220	4
249	Kupang	Bokin-Soe	0	0	0	0	10	0	0	0	5	15	231	4
250	Kupang	Kiniwai Laratarne	10	0	0	0	2.5	0	0	0	5	17.5	183	4
251	Kupang	Labuhan bajo	5	5	0	0	10	0	0	0	5	25	102	3

Appendix 1.1.5.

Priority of Development of Visual Aids to Navigation in Master Plan

(Light Beacon)

No.	DISNAV	Location	Land fall	Turning point	Dangers	Marine casualty	Marine traffic route	Sea-lane	Existing Port	SISTRANAS	Traffic demand	Total Score	Priority	Phase
251	Kupang	Labuhan bajo	5	5	0	0	10	0	0	0	5	25	102	3
252	Kupang	Labuhan bajo	0	5	0	0	10	0	1	0	5	21	148	3
253	Kupang	Mananga	0	0	5	0	10	0	0	0	5	20	155	3
254	Kupang	Nangalill-Ruteng	0	0	0	0	2.5	0	1	0	5	8.5	309	5
255	Kupang	P.Sukur	5	5	0	0	2.5	0	0	0	5	17.5	183	4
256	Kupang	Pel. Aimere	10	0	0	0	2.5	0	1	0	5	18.5	173	4
257	Kupang	Pelab. Walngapu	0	0	0	0	10	0	2	0	5	17	216	4
258	Kupang	Pelab. Walngapu	0	0	0	0	10	0	2	0	5	17	217	4
259	Kupang	Tg. Kumba	2.5	5	5	0	2.5	0	2	2	5	24	118	3
260	Kupang	Tg. Tutunnila	10	0	0	0	5	2.5	0	0	5	22.5	125	3
261	Kupang	Tg. Uwakeka	5	0	5	0	2.5	10	0	0	5	27.5	69	3
262	Kupang	Tg.Batu putih	0	0	0	0	10	0	0	0	5	15	231	4
263	Kupang	Tg.Batuata	0	5	0	0	10	0	0	0	5	20	155	4
264	Kupang	Tg.Kumba	0	0	5	0	2.5	0	0	2	5	14.5	248	4
265	Kupang	Tg.Wokar	0	5	0	0	0	0	0	0	5	10	285	5
266	Kupang	Trong	0	0	5	0	0	0	1	0	5	11	276	5
267	Ambon	Pel.Tobelo	0	0	2.5	0	10	0	1	0	5	18.5	173	4
268	Ambon	Pel.Tobelo	0	5	2.5	0	10	0	0	0	5	22.5	125	3
269	Ambon	Pel.Tobelo	0	0	2.5	0	10	0	0	0	5	17.5	183	4
270	Ambon	Pel.Tobelo	0	0	2.5	0	10	0	0	0	5	17.5	183	4
271	Ambon	Pu. Krus	0	0	5	0	10	0	0	0	5	20	155	4
272	Ambon	Tg.Karbau	0	5	0	0	10	0	1	0	5	21	148	3
273	Jayapura	Kr.Jaunan	0	0	0	0	10	0	1	0	2.5	13.5	250	4
274	Jayapura	P.Ayawi	10	0	10	0	5	0	0	0	2.5	27.5	69	3
275	Jayapura	P.Isomanai	0	0	0	0	5	0	1	0	2.5	8.5	309	5
276	Jayapura	P.Mengge	0	0	0	0	5	0	1	0	2.5	8.5	309	5
277	Jayapura	P.Miosindi	0	5	5	0	10	0	0	0	2.5	22.5	125	3
278	Jayapura	P.Miospandi	5	5	5	0	5	0	1	0	2.5	23.5	119	3
279	Jayapura	P.Nutabari	0	5	0	0	5	0	1	0	2.5	13.5	250	4
280	Jayapura	P.Roon	0	5	0	0	2.5	0	0	0	2.5	10	285	5
281	Jayapura	P.Rurbas Beba	0	5	10	0	10	0	0	0	2.5	27.5	69	3
282	Jayapura	P.Wairundi	5	5	0	0	10	0	1	0	2.5	23.5	119	3
283	Jayapura	Pel.Bosnik	0	0	0	0	10	0	5	0	2.5	17.5	183	4
284	Jayapura	Sorido	0	0	0	0	10	0	5	5	2.5	22.5	125	3
285	Jayapura	Sorido	0	0	0	0	10	0	5	0	2.5	17.5	183	4
286	Jayapura	Tg. Abwari	0	0	10	0	2.5	0	0	0	2.5	15	231	4
287	Jayapura	Tg. Mangguar	0	5	0	0	2.5	0	0	0	2.5	10	285	5
288	Jayapura	Tg. Riarwepam	0	5	0	0	2.5	0	1	0	2.5	11	276	5
289	Jayapura	Tg. Yobi	5	5	0	0	10	0	0	0	2.5	22.5	125	3
290	Jayapura	Tg.Arrareni	2.5	5	0	0	10	0	0	0	2.5	20	155	4
291	Jayapura	Tg.Nube	5	5	0	0	10	0	1	0	2.5	23.5	119	3
292	Jayapura	Tg.Praisbari	5	5	0	0	5	0	0	0	2.5	17.5	183	4
293	Jayapura	Tg.Rimon	0	5	0	0	2.5	0	1	0	2.5	11	276	5
294	Jayapura	Tg.S.Apauwar	0	0	0	0	10	0	1	0	2.5	13.5	250	5
295	Jayapura	Tg.Tanah Merah	0	0	0	0	10	0	5	0	2.5	17.5	183	4
296	Jayapura	Tg.Tmbieri	5	5	0	0	5	0	1	0	2.5	18.5	173	4
297	Jayapura	TgAyami	0	5	2.5	0	2.5	0	0	0	2.5	12.5	259	5
298	Jayapura	Waren	0	5	0	0	10	0	1	0	2.5	18.5	173	4
299	Sorong	Bintuni	0	0	0	0	2.5	0	1	3	2.5	9	304	5
300	Sorong	Daram	0	5	0	0	10	0	0	0	2.5	17.5	183	4
301	Sorong	Fujlu	0	5	0	0	10	0	0	0	2.5	17.5	183	4

Appendix 1.1.5.
Priority of Development of Visual Aids to Navigation in Master Plan
(Light Beacon)

No.	DISNAV	Location	Land fall	Turning point	Dangers	Marine casualty	Marine traffic route	Sea-lane	Existing Port	SISTRANAS	Traffic demand	Total Score	Priority	Phase
301	Sorong	Fuilu	0	5	0	0	10	0	0	0	2.5	17.5	183	4
302	Sorong	Gs. Masmasbus	0	5	0	0	10	0	0	0	2.5	17.5	183	4
303	Sorong	Kr.P.Tubiserang	0	0	0	0	10	0	2	0	2.5	14.5	248	4
304	Sorong	Kr.Selat Sele	0	5	0	0	10	0	0	0	2.5	17.5	183	4
305	Sorong	P.Sagin	0	5	0	0	10	0	1	0	2.5	18.5	173	4
306	Sorong	P.Wayam	0	5	0	0	10	0	0	0	2.5	17.5	183	4
307	Sorong	Tg. Sekar	2.5	5	0	0	2.5	0	1	0	2.5	13.5	250	4
308	Sorong	Tg.Dore	2.5	5	2.5	0	10	0	1	0	2.5	23.5	119	3
309	Sorong	Tg.Dore	2.5	5	2.5	0	10	0	1	0	2.5	23.5	119	3
310	Sorong	Tg.Monfafa	0	5	0	0	10	0	0	0	2.5	17.5	183	4
311	Sorong	Tg.Mupi	0	0	0	0	10	0	0	0	2.5	12.5	259	5
312	Sorong	Tg.Nasaulang	0	5	0	0	10	0	0	0	2.5	17.5	183	4
313	Sorong	Tg.Opmarai	0	0	0	0	5	0	1	0	2.5	8.5	309	5
314	Sorong	Tg.Poweri	2.5	0	0	0	10	0	1	0	2.5	16	220	4
315	Sorong	Tg.Saweba	0	5	0	0	10	0	1	0	2.5	18.5	173	4
316	Sorong	Tg.Tongerai	0	5	0	0	2.5	0	1	0	2.5	11	276	5
317	Sorong	Tg.Wariai	0	5	0	0	2.5	0	1	0	2.5	11	276	5
318	Sorong	Tg.Wibain	0	0	0	0	10	0	0	0	2.5	12.5	259	5
319	Merauke	Gs.Triton	2.5	0	0	0	10	0	1	0	2.5	16	220	4
320	Merauke	Ma.S. Sawaerma	2.5	0	0	0	10	0	1	0	2.5	16	220	4
321	Merauke	Ma.S.Kumbe	2.5	0	0	0	10	0	2	2	2.5	19	171	4
322	Merauke	Ma.S.Kumbe	2.5	0	0	0	2.5	0	2	2	2.5	11.5	274	5

Appendix 1.1.6.
Development of Aids to Navigation in Master Plan (Lighthouse)

No.	DISNAV	Location	Latitude	Longitude	Structure Height (GL:)	Site	Total Score	Priority	Phase
1	Sabang	Uj. Mangki	02-55-25N	097-26-41E	40	On Land	16.250	89	5
2	Sabang	Uj. Pesangan	05-16-45N	096-49-46E	40	On Land	24.250	55	4
3	Belawan	Tg. Pertandangan	02-42-29N	100-13-30E	40	On Land	21.000	67	4
4	Tg.Pinang	Nunbing	00-44-00N	104-17-10E	40	On Land	30.000	27	3
5	Tg.Pinang	P. Panjang	04-15-23N	108-12-37E	10	On Land	51.000	2	1
6	Tg.Pinang	P.Seraya	02-41-00N	108-34-51E	40	On Land	28.500	32	3
7	Tg.Pinang	P.Timau	03-17-19N	107-33-14E	10	On Land	43.500	3	1
8	Tg.Pinang	Tg. Cakang	00-36-34N	104-17-10E	40	On Land	35.000	17	3
9	Tg.Pinang	Tg. Kemantan	00-59-39N	107-35-59E	40	On Land	37.000	12	2
10	Tg.Pinang	Tg. Sading	01-11-48N	104-23-40E	40	On Land	57.500	1	1
11	Tlk. Bayur	Uj. Talukasai	01-25-30S	100-33-30E	40	On Land	17.500	82	5
12	Tlk. Bayur	Uj. Tanjung	02-09-19S	100-48-59E	40	On Land	17.500	82	5
13	Palembang	Ayermasin	03-15-00S	108-23-00E	40	On Land	38.500	8	2
14	Palembang	P. Cebia	01-12-21S	105-16-02E	40	On Land	37.500	12	1
15	Palembang	Tg. Lesum	01-38-55S	105-20-54E	40	On Land	32.500	22	1
16	Palembang	Tg. Kait	03-13-00S	106-03-59E	40	On Land	33.500	19	3
17	Palembang	Uj. Batakarang	02-00-42S	104-50-16E	40	On Land	37.500	12	1
18	Tg. Priok	Sanding	03-28-50S	100-40-20E	40	On Land	27.500	39	3
19	Tg. Priok	Seblat	03-14-14S	101-36-46E	40	On Land	17.500	82	5
20	Tg. Priok	Tg. Gedeh	07-44-00S	107-50-30E	40	On Land	22.500	62	4
21	Tg. Priok	Tg. Losari	06-45-14S	108-49-20E	40	On Land	23.500	57	4
22	Tg. Priok	Tg. Sedari	05-58-00S	107-19-59E	40	On Land	23.500	57	4
23	Tg. Priok	Uj. Genteng	07-22-49S	106-24-15E	40	On Land	38.500	8	2
24	Tg. Priok	Uj. Tk. Punggur	03-55-09S	102-16-05E	40	On Land	30.000	27	3
25	Semarang	Tg. Pemalang	06-48-25S	109-29-36E	40	On Land	23.000	57	4
26	Surabaya	Memburit	06-50-02S	115-13-00E	40	On Land	41.000	4	1
27	Surabaya	Tg. Sbkah	08-42-39S	114-35-59E	40	On Land	30.000	27	3
28	Benoa	P. Menjangan	08-05-38S	114-31-36E	40	On Land	41.500	4	1
29	Benoa	Marba	08-12-30S	116-21-10E	40	On Land	28.500	32	3
30	Benoa	Tg. Amat	08-58-40S	116-42-51E	40	On Land	21.000	67	4
31	Benoa	Tg. Lessek	09-01-59S	117-26-00E	40	On Land	20.000	74	4
32	Benoa	Tg. Tekurenan	08-10-45S	115-28-46E	40	On Land	32.500	22	2
33	Pontianak	Tg. Bangka	00-20-45N	108-55-00E	40	On Land	27.500	39	3
34	Banjarmasin	Tg. Dewa	03-07-40S	116-16-20E	40	On Land	40.500	7	3
35	Banjarmasin	Tg. Selaka	03-04-00S	110-58-15E	40	On Land	20.000	74	4
36	Samarinda	Tg. Bayur	00-43-34S	117-36-15E	40	On Land	25.000	51	4
37	Samarinda	Tg. Jumalai	01-21-20S	116-45-41E	40	On Land	38.000	8	3
38	Samarinda	Tg. Perupu	01-46-25N	118-03-15E	40	On Land	16.000	90	5
39	Samarinda	Tg.Aru	02-11-00S	116-34-59E	40	On Land	38.500	8	2
40	Tarakan	Ma. Pekin	02-57-24N	117-41-30E	40	On Land	16.500	88	5
41	Manado/Bitung	Buang Buang	02-04-20S	123-55-00E	40	On Land	31.000	24	3
42	Manado/Bitun	P. Bentenan	00-58-00N	124-45-59E	40	On Land	24.000	55	4
43	Manado/Bitung	P. Puludua	00-49-23S	123-27-37E	40	On Land	20.000	74	4
44	Manado/Bitung	P.Makalehi	02-43-50N	125-10-20E	40	On Land	26.000	47	3
45	Manado/Bitung	P.Sago	02-12-49S	123-09-00E	40	On Land	22.500	62	4
46	Manado/Bitun	Tg. Api	00-47-49S	121-38-46E	40	On Land	28.500	32	3

Appendix 1.1.6.
Development of Aids to Navigation in Master Plan
(Lighthouse)

No.	DISNAV	Location	Latitude	Longitude	Structure Height (GL:)	Site	Total Score	Priority	Phase
46	Manado/Bitun	Tg. Api	00-47-49S	121-38-46E	40	On Land	28.500	32	3
47	Manado/Bitun	Tg. Dominango	00-18-00N	123-45-59E	40	On Land	16.000	90	5
48	Manado/Bitung	Tg.TALABU	00-46-00S	123-27-00E	40	On Land	20.000	74	4
49	Kendari	P. Sainoa	03-07-35S	122-36-59E	40	On Land	30.000	27	3
50	Kendari	P.Anano	05-18-00S	124-17-59E	40	On Land	35.000	17	2
51	Kendari	Tg. Goram	04-52-00S	123-12-30E	40	On Land	21.000	67	4
52	Makassar	P. Sagara	04-42-24S	119-27-00E	40	On Land	36.000	15	3
53	Makassar	Tg. Bodio	04-04-59S	119-36-30E	40	On Land	31.500	24	3
54	Kupang	P. Raja	08-17-29S	121-50-12E	40	On Land	26.000	47	3
55	Kupang	P.Nusa Ende	08-54-33S	121-30-59E	40	On Land	25.500	51	4
56	Kupang	Seraja Besar	08-22-19S	119-51-20E	40	On Land	41.000	4	2
57	Kupang	Tg. Boda	08-32-58S	124-03-41E	40	On Land	27.500	39	3
58	Kupang	Tg. Mas	09-27-51S	123-40-10E	40	On Land	28.500	32	3
59	Kupang	Tg. Muna	08-11-00S	124-18-30E	40	On Land	33.000	19	2
60	Kupang	Tg. Kopondai	08-03-59S	122-50-12E	40	On Land	21.000	67	4
61	Ambon	Banda Besar	04-34-19S	129-55-51E	40	On Land	28.500	32	3
62	Ambon	Batusambo	00-18-19S	127-33-41E	40	On Land	18.500	78	4
63	Ambon	Manuwui	07-42-00S	129-39-59E	40	On Land	18.500	78	4
64	Ambon	P. Ambelau	03-54-00S	127-13-10E	40	On Land	22.500	62	4
65	Ambon	P. Ceramrei	03-52-30S	130-51-51E	40	On Land	26.000	47	3
66	Ambon	P. Damar	07-07-10S	128-41-51E	40	On Land	21.000	67	4
67	Ambon	P. Nusalaut	03-41-29S	128-46-59E	40	On Land	18.500	78	4
68	Ambon	P.P. Maisel	05-28-25S	127-30-56E	40	On Land	22.500	62	4
69	Ambon	P.Pombo tinggi	03-31-29S	128-22-35E	40	On Land	26.000	47	4
70	Ambon	Sarangburung	00-15-45S	127-00-59E	40	On Land	27.500	39	3
71	Ambon	Tg. Hatanua	02-54-39S	127-55-20E	40	On Land	30.000	27	3
72	Ambon	Tg. Libobo	00-54-39S	128-26-51E	40	On Land	17.500	82	5
73	Ambon	Tg. Namaa	02-47-39S	129-03-00E	40	On Land	22.500	62	4
74	Ambon	Tg. Ngolopopo	00-12-40N	128-53-41E	40	On Land	25.000	51	4
75	Ambon	Tg. Weduar	06-00-30S	132-50-30E	40	On Land	36.000	15	2
76	Ambon	Tg.Sial	03-33-19S	127-56-00E	40	On Land	31.000	24	3
77	Ambon	Tg.Watina	03-53-19S	126-41-30E	40	On Land	23.500	57	4
78	Ambon	Walwat tinggi	03-37-20S	126-11-41E	40	On Land	33.500	19	2
79	Jayapura	P. Anus	02-07-30S	139-30-46E	40	On Land	28.500	32	3
80	Jayapura	P. Miosnum	01-30-00S	136-00-00E	40	On Land	25.500	51	4
81	Jayapura	Tg. Mandundi	00-37-49S	135-21-41E	40	On Land	28.500	32	3
82	Sorong	P. Daram	02-09-45S	130-55-51E	40	On Land	27.500	39	3
83	Sorong	P. Tumbutumbu	04-19-14S	133-29-30E	40	On Land	23.500	57	4
84	Sorong	P.Ayu	00-21-45N	131-03-36E	40	On Land	18.500	78	5
85	Sorong	Tg. Namaripi	04-27-49S	135-11-59E	40	On Land	17.500	82	5
86	Sorong	Tg. Ngoni	06-10-15S	134-04-46E	40	On Land	27.500	39	3
87	Sorong	Tg. Papisoi	04-07-10S	133-00-25E	40	On Land	27.500	39	3
88	Sorong	Tg. Saweba	00-43-00S	133-56-51E	40	On Land	21.500	67	4
89	Sorong	Tg. Wesio	00-22-00S	132-43-00E	40	On Land	17.500	82	5
90	Sorong	Tg.OPENTA	01-50-00S	130-26-51E	40	On Land	27.500	39	3
91	Sorong	Waveteri	04-53-44S	136-46-30E	40	On Land	21.000	67	4

Appendix 1.1.7.
Development of Aids to Navigation in Master Plan
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No.	DISNAV	Location	Latitude	Longitude	Structure Height (GL:)	Site	Total Score	Priority	Phase
1	Sabang	Kr. Biawak	02-17-57N	097-20-06E	10	Offshore	21.25	147	3
2	Sabang	Kr.Gatui	05-12-45N	097-17-11E	10	On Land	19.25	170	4
3	Sabang	Lhok Seumawe	05-09-57N	097-08-43E	30	On Land	16.75	218	4
4	Sabang	P.Batu.Belayar	02-25-27N	096-31-13E	20	On Land	8.75	305	5
5	Sabang	P.Ina	02-55-09N	095-45-30E	30	On Land	8.75	305	5
6	Sabang	P.Lakon	02-42-29N	095-43-10E	20	On Land	8.75	305	5
7	Sabang	P.Rubiah	05-52-35N	095-15-20E	20	On Land	25.75	100	3
8	Sabang	Sinabang	01-28-35N	096-22-47E	10	Offshore	18.75	172	4
9	Sabang	Tg. Sabin	02-41-08N	096-08-56E	30	On Land	8.75	305	5
10	Sabang	Tg.Ketaping	02-06-44N	097-05-46E	30	On Land	11.25	275	5
11	Sabang	Uj.Lampuyang	05-40-05N	095-08-20E	20	On Land	16.25	218	4
12	Sabang	Uj.Meuduroe	05-46-24N	095-19-30E	20	On Land	23.25	124	3
13	Belawan	Sei. Berombang	02-38-04N	100-06-27E	10	Offshore	10	285	5
14	Belawan	Sei. Berombang	02-47-15N	100-05-59E	10	Offshore	17.5	183	4
15	Belawan	Tg.Tiram	03-13-08N	099-35-01E	10	Offshore	27.5	69	3
16	Sibolga	Amboina	02-28-14N	097-36-30E	10	On Land	22.5	125	3
17	Sibolga	Kr.Karang	00-42-45N	098-56-15E	10	On Land	30	53	2
18	Sibolga	Kr.Kasi	02-10-18N	097-50-25E	10	Offshore	12.5	259	5
19	Sibolga	Kr.Lago	00-01-27N	098-27-18E	20	On Land	31	47	2
20	Sibolga	Kr.Tonga	00-01-59N	098-44-30E	10	Offshore	31	47	2
21	Sibolga	P.Jawijawi	02-22-45N	097-33-30E	20	On Land	22.5	125	3
22	Sibolga	P.Sarudut	01-43-41N	098-46-36E	20	On Land	32	44	2
23	Sibolga	P.Wunge	01-12-44N	097-05-30E	20	On Land	22.5	125	3
24	Sibolga	Pel.Sibolga	01-44-38N	096-46-02E	20	On Land	30	53	2
25	Sibolga	Pel.Sikara-kara	00-37-37N	099-03-51E	20	On Land	15	231	4
26	Sibolga	Tg.Bai	00-03-24S	098-31-12E	20	On Land	25	102	3
27	Sibolga	Tg.Ikhunene	00-33-28N	097-44-05E	20	On Land	22.5	125	3
28	Sibolga	Tg.Lambaru	01-08-59N	097-47-59E	30	On Land	25	102	3
29	Sibolga	Tg.Siginigini	01-32-20N	097-20-59E	20	On Land	16	220	4
30	Sibolga	Tg.Toyolawa	01-24-29N	098-03-10E	20	On Land	20	155	4
31	Sibolga	Ug. Batu Panjang	01-40-05N	098-32-38E	20	On Land	17.5	183	4
32	Sibolga	Ug.Teduihu	00-42-39N	097-53-30E	20	On Land	15	231	4
33	Dumai	Tg. Sinaboi	02-17-37N	101-02-05E	30	On Land	25	102	3
34	Dumai	Gs.Mumbul	02-03-17N	101-25-38E	10	Offshore	42.5	12	1
35	Dumai	Pel.Kuala Enok	00-31-59S	103-26-38E	10	Offshore	37.5	23	1
36	Dumai	Pel.Kuala Enok	03-32-51S	103-27-42E	10	Offshore	37.5	23	1
37	Dumai	Pel.Kuala Enok	00-34-57S	103-29-10E	10	Offshore	37.5	23	1
38	Dumai	Selatan P.Tengah	01-07-20N	102-09-34E	10	Offshore	38	20	1
39	Dumai	Tg.Layang	01-13-22N	102-10-29E	10	Offshore	38	20	1
40	Dumai	Utara P.Tengah	01-08-13N	102-09-35E	10	Offshore	38	20	1

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No.	DISNAV	Location	Latitude	Longitude	Structure Height (GL:)	Site	Total Score	Priority	Phase
41	Tg.Pinang	P. Ritan	02-35-47N	106-16-29E	10	On Land	45	9	1
42	Tg.Pinang	Batu Berlayar	00-24-51N	107-15-30E	10	Offshore	25	102	3
43	Tg.Pinang	Karang Singa	01-06-00N	104-21-51E	10	Offshore	10	285	5
44	Tg.Pinang	Kr.Jackson	02-58-59N	107-53-25E	10	On Land	27.5	69	3
45	Tg.Pinang	Kr.Nginang	00-58-50N	104-09-31E	10	Offshore	45	9	1
46	Tg.Pinang	LAP.1955(2m)	02-57-29N	108-22-10E	10	On Land	25	102	3
47	Tg.Pinang	Lap.1980	01-43-59N	107-24-30E	10	Offshore	30	53	2
48	Tg.Pinang	P. Batuberlayar	00-24-08N	104-14-53E	10	On Land	35	31	1
49	Tg.Pinang	P.Selanga	00-29-15N	104-21-23E	20	On Land	35	31	1
50	Tg.Pinang	P.Tokong Kemudi	00-55-14N	109-44-24E	10	On Land	15	231	4
51	Tg.Pinang	Pel. Letung	02-59-39N	105-42-30E	20	On Land	28.5	63	3
52	Tg.Pinang	Pel.Midai	02-59-44N	107-44-39E	10	Offshore	46	4	1
53	Tg.Pinang	Pel.Midai	03-00-00N	107-44-38E	10	Offshore	46	4	1
54	Tg.Pinang	Pel.Midai	02-59-57N	107-44-52E	20	On Land	46	4	1
55	Tg.Pinang	Pl.Selanga	00-03-00N	104-21-20E	20	On Land	13.5	250	4
56	Tg.Pinang	Sel.Kijang	00-48-45N	104-35-56E	10	Offshore	26	94	3
57	Tg.Pinang	Sel.Kijang	00-48-39N	104-36-05E	10	Offshore	26	94	3
58	Tg.Pinang	P. Senggakang	00-55-43N	104-25-31E	10	Offshore	47.5	2	1
59	Tg.Pinang	P. Penyengat	00-55-16N	104-25-05E	10	Offshore	47.5	2	1
60	Tg.Pinang	Tg.Gabi	00-47-48N	104-38-10E	10	Offshore	26	94	3
61	Tlk. Bayur	Kr. P. Langaraik	01-04-04S	099-57-04E	10	Offshore	27.5	69	3
62	Tlk. Bayur	Kr. Pincuran Butun	00-11-39N	099-21-54E	10	Offshore	31.5	46	2
63	Tlk. Bayur	Kr. Sijau-Jau	02-31-14S	100-02-27E	10	Offshore	17.5	183	4
64	Tlk. Bayur	Kr. Stort	00-54-34S	099-59-10E	10	Offshore	27.5	69	3
65	Tlk. Bayur	P. Laut	01-08-14S	100-10-00E	10	On Land	30.5	50	2
66	Tlk. Bayur	Tg. Simatobe	02-38-44S	100-10-10E	20	On Land	13.5	250	5
67	Palembang	Kr. Haji	02-05-33S	105-06-23E	10	Offshore	42.5	12	1
68	Palembang	Ma. Kuala Tungkal	00-47-40S	103-30-40E	10	Offshore	37.5	23	1
69	Palembang	Ma. Kuala Tungkal	00-46-01S	103-32-00E	10	Offshore	37.5	23	1
70	Palembang	Ma.Ka. Berbak	00-58-59S	104-10-20E	10	Offshore	8.5	309	5
71	Palembang	P.Gaspar	02-25-00S	107-04-59E	30	On Land	27.5	69	3
72	Palembang	P.Lalang	01-57-29S	104-28-30E	20	On Land	10	285	5
73	Palembang	P.tokong Kembang	01-07-30S	105-14-15E	30	On Land	20	155	4
74	Palembang	Selat Nando	02-55-14S	107-26-49E	10	Offshore	35.5	23	1
75	Palembang	Tg. Terentang	01-34-58S	105-43-13E	10	Offshore	37.5	23	1
76	Palembang	Tg.Buyut	02-21-50S	104-54-53E	30	On Land	20	155	4
77	Tg. Priok	Tg. Batu Kebutjung	05-50-24S	104-51-31E	10	On Land	22.5	125	3
78	Tg. Priok	Bayangan Air	05-44-54S	105-58-59E	10	Offshore	35	31	2
79	Tg. Priok	Gs. Tohorjantan	05-47-25S	106-47-51E	10	On Land	37.5	23	2
80	Tg. Priok	Kr. Gundul	05-51-20S	106-34-12E	10	Offshore	35	31	1

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No.	DISNAV	Location	Latitude	Longitude	Structure Height (GL:)	Site	Total Score	Priority	Phase
81	Tg. Priok	Kr. Kerbau	05-46-11S	106-26-29E	10	Offshore	45	9	1
82	Tg. Priok	Indramayu	06-25-00S	108-17-00E	10	Offshore	13.5	250	4
83	Tg. Priok	Cirebon	06-42-16S	108-34-04E	10	Offshore	10	285	5
84	Tg. Priok	Kr. Rakit Utara	05-48-00S	108-26-41E	10	On Land	27.5	69	3
85	Tg. Priok	P.Selanga	00-29-49S	104-21-10E	20	On Land	10	285	5
86	Tg. Priok	Tg. Selokan	02-22-59S	105-37-00E	10	Offshore	27.5	69	3
87	Tg. Priok	Tg.Karawang	05-55-55S	106-58-48E	10	Offshore	40	16	1
88	Semarang	Alur Pel. Karimun Jawa	05-53-27S	110-26-18E	10	Offshore	35	31	1
89	Semarang	Alur Pel. Karimun Jawa	05-53-10S	110-26-18E	10	Offshore	35	31	1
90	Semarang	Alur Pel. Karimun Jawa	05-53-08S	110-26-55E	10	Offshore	35	31	1
91	Semarang	Kr Seliro	06-41-22S	111-19-12E	10	On Land	15	231	4
92	Semarang	Kr. Masaran	06-40-09S	111-18-44E	10	On Land	12.5	259	5
93	Semarang	Kr. Sverre	06-01-59S	110-20-59E	10	Offshore	27.5	69	3
94	Semarang	Kr. Wen-wen	06-39-33S	111-18-20E	10	On Land	17.5	183	4
95	Semarang	Pel. Rembang	06-42-24S	111-19-30E	20	On Land	12.5	259	5
96	Cilacap	Baron	08-36-00S	110-44-59E	20	On Land	25	102	3
97	Cilacap	Tg. Sunanggu	07-43-23S	108-40-18E	10	Offshore	20	155	4
98	Cilacap	Tg. Watukarang	08-14-38S	110-58-30E	20	On Land	17.5	183	4
99	Surabaya	Gs. Balam	06-24-55S	115-13-15E	10	Offshore	22.5	125	3
100	Surabaya	GS. Castor	07-19-00S	112-53-00E	10	Offshore	52.5	1	1
101	Surabaya	P. Gililawak	07-12-24S	114-02-41E	20	On Land	32	44	2
102	Surabaya	P. Giliyang	06-58-35S	114-11-15E	20	On Land	32.5	41	2
103	Surabaya	P. Kambing	07-18-29S	113-13-15E	10	Offshore	30	53	2
104	Surabaya	P.Sepekan	07-00-57S	115-42-44E	20	On Land	42.5	12	1
105	Surabaya	Pel. Kangean	06-51-14S	115-14-50E	20	On Land	25	102	3
106	Benoa	P. Belang	08-33-14S	116-48-38E	20	On Land	13.5	250	4
107	Benoa	Tg. Pasir	08-05-49S	114-26-05E	20	On Land	25.5	101	3
108	Benoa	Tg.Kramitan	08-40-45S	115-34-00E	30	On Land	28.5	63	3
109	Pontianak	Kr.Co	00-47-49S	109-48-30E	10	Offshore	9.5	303	5
110	Pontianak	Ma. Kendawangan	02-31-19S	110-11-32E	10	Offshore	17.5	183	4
111	Pontianak	Ma. Kendawangan	02-31-09S	110-11-47E	20	On Land	17.5	183	4
112	Pontianak	Ma. Kendawangan	02-31-41S	110-10-41E	10	Offshore	15	231	4
113	Pontianak	Ma. Kendawangan	02-31-46S	110-10-51E	10	Offshore	12.5	259	5
114	Banjarmasin	Kp.Baru	03-25-37S	116-00-16E	10	On Land	26	94	3
115	Banjarmasin	Kp.Baru	03-35-42S	116-00-08E	10	On Land	21	148	3
116	Banjarmasin	Ma. S. Barito	03-32-38S	114-29-42E	10	Offshore	30.5	50	2
117	Banjarmasin	Ma. S. Barito	03-32-25S	114-29-51E	10	Offshore	30.5	50	2
118	Banjarmasin	Ma. S. Kahayan	03-15-10S	114-00-15E	10	Offshore	8.5	309	5
119	Banjarmasin	Ma. S. Kahayan	03-18-14S	114-00-33E	10	Offshore	8.5	309	5
120	Banjarmasin	P. KadaPangan	04-40-45S	115-45-00E	10	On Land	27.5	69	3

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No.	DISNAV	Location	Latitude	Longitude	Structure Height (GL:)	Site	Total Score	Priority	Phase
121	Banjarmasin	P. Pamelika	04-44-44S	115-52-30E	10	On Land	27.5	69	3
122	Banjarmasin	Sei.Kahayan no.3	03-19-15S	114-03-51E	10	On Land	18.5	173	4
123	Banjarmasin	Sei.Kahayan no.4	03-19-05S	114-03-47E	10	On Land	16	220	4
124	Banjarmasin	Sei.Kahayan no.6	03-18-18S	114-04-30E	10	On Land	16	220	4
125	Banjarmasin	Sei.Kahayan no.7	03-13-14S	114-04-33E	10	On Land	8.5	309	5
126	Banjarmasin	Sei.Mentaya(green)	02-59-24S	113-03-12E	10	On Land	22.5	125	3
127	Banjarmasin	Tg. Burung	03-33-10S	114-31-00E	20	On Land	28	68	3
128	Samarinda	G s.Rending	00-52-13N	118-02-41E	10	Offshore	21	148	3
129	Samarinda	Kr. Grogot	02-43-59S	116-45-30E	10	On Land	22.5	125	3
130	Samarinda	Kr.Unarang	02-25-48S	117-02-30E	10	Offshore	32.5	41	2
131	Samarinda	Muara Berau	00-32-30S	117-24-49E	10	Offshore	39	19	2
132	Tarakan	Kr.Adat	03-20-30N	117-52-37E	10	Offshore	22.5	125	3
133	Tarakan	Tg.Buasin	02-58-36N	117-52-37E	10	Offshore	22.5	125	3
134	Tarakan	Tg.Keris	03-16-00N	117-32-37E	10	Offshore	27	93	3
135	Tarakan	Tg.Sadau	03-20-53N	117-31-18E	10	Offshore	22	146	3
136	Manado/Bitung	Batu tengah	01-56-15S	121-19-59E	10	On Land	18.5	173	4
137	Manado/Bitung	Karang Vesuvius	02-04-50S	122-52-00E	10	Offshore	25	102	3
138	Manado/Bitung	Kolonedale	01-59-25S	121-20-08E	10	On Land	16	220	4
139	Manado/Bitung	Kr. Jasina	01-03-05N	123-10-05E	10	Offshore	27.5	69	3
140	Manado/Bitung	Kr. Teluk Mundung	02-06-29N	125-20-30E	10	Offshore	15	231	4
141	Manado/Bitung	Kr. Tg. Tobayagan	00-23-30N	124-18-41E	10	Offshore	12.5	259	5
142	Manado/Bitung	Mentarawu(P.Nain)	01-46-59N	125-46-59E	30	On Land	25	102	3
143	Manado/Bitung	Napu Arampua	04-38-17N	127-04-47E	10	Offshore	43.5	12	1
144	Manado/Bitung	P. Biaro	02-07-40N	125-40-30E	30	On Land	22.5	125	3
145	Manado/Bitung	P. Saaru/Napu Mbalu	03-37-54N	126-52-00E	10	Offshore	17.5	183	4
146	Manado/Bitung	P.Azasal	01-28-59S	123-31-00E	10	On Land	22.5	125	3
147	Manado/Bitung	P.Nitu	03-04-40N	125-28-30E	20	On Land	22.5	125	3
148	Manado/Bitung	P.Potil Kecil	01-27-00S	123-33-30E	10	On Land	25	102	3
149	Manado/Bitung	P.Sanggeluhang	02-57-20N	125-28-20E	10	Offshore	30	53	2
150	Manado/Bitung	P.Tempau	01-53-30S	124-01-51E	30	On Land	20	155	4
151	Manado/Bitung	P.Tifore	00-57-24N	126-09-35E	30	On Land	20	155	4
152	Manado/Bitung	Pel,Banggai	01-35-20S	123-30-10E	20	On Land	15	231	4
153	Manado/Bitung	Pel. Bunta	00-49-59S	122-10-00E	20	On Land	8.5	309	5
154	Manado/Bitung	Pel.Ampana	00-57-02N	122-47-34E	10	On Land	15	231	4
155	Manado/Bitung	Pel.Bitung	01-25-59N	125-10-59E	20	On Land	28.5	63	3
156	Manado/Bitung	Awit	04-19-30N	126-41-14E	20	On Land	46	4	1
157	Manado/Bitung	Pel.Paleleh	01-03-10N	121-57-41E	10	On Land	12.5	259	5
158	Manado/Bitung	Pel.Paleleh	01-03-10N	121-57-30E	20	On Land	12.5	259	5
159	Manado/Bitung	Pel.Tamako	03-26-49N	125-29-33E	20	On Land	46	4	1
160	Manado/Bitung	PelAmpana	00-51-50S	121-33-30E	20	On Land	11	276	5

Appendix 1.1.7.
Development of Aids to Navigation in Master Plan
(Light Beacon)

No.	DISNAV	Location	Latitude	Longitude	Structure Height (GL:)	Site	Total Score	Priority	Phase
161	Manado/Bitung	Sanggelukang	02-57-29N	125-27-00E	10	On Land	30	53	2
162	Manado/Bitung	Telk Boraag uki	00-51-06N	123-55-59E	10	Offshore	10	285	5
163	Manado/Bitung	Tg, Panango	00-21-00N	124-02-51E	30	On Land	11	276	5
164	Manado/Bitung	Tg. Ibaiba	00-16-59N	132-40-25E	30	On Land	22.5	125	3
165	Manado/Bitung	Tg. Liku	01-45-20N	124-58-59E	10	On Land	25	102	3
166	Manado/Bitung	Tg. Puisan	01-40-59N	125-10-30E	10	On Land	17.5	183	4
167	Manado/Bitung	Tg. Tombaliatu	00-17-30N	123-20-20E	30	On Land	10	285	5
168	Manado/Bitung	Tg. Papalanpungan	03-58-52N	126-44-38E	30	On Land	40	16	1
169	Manado/Bitung	Tg.Pamali	01-16-59S	123-33-30E	30	On Land	20	155	4
170	Manado/Bitung	Tg.Pamali	01-16-59N	123-33-43E	20	On Land	12.5	259	5
171	Kendari	Bungku Toko	03-58-35S	122-36-10E	10	Offshore	20.5	154	3
172	Kendari	Gs. Saponda Selatan	04-02-31S	122-46-59E	10	Offshore	27.5	69	3
173	Kendari	Gs. Selatan	03-26-09S	122-30-25E	10	Offshore	27.5	69	3
174	Kendari	Gs. Utara	03-23-04S	122-29-33E	10	Offshore	27.5	69	3
175	Kendari	Kr. Barat Langara Bugis	04-01-41S	122-57-52E	10	Offshore	10	285	5
176	Kendari	Kr. Barat P. Maloan	04-38-44S	122-15-10E	10	Offshore	20	155	3
177	Kendari	Kr. Bokori	03-57-39S	122-39-41E	10	Offshore	13	258	5
178	Kendari	Kr. Dungi	03-51-29S	120-59-46E	10	Offshore	17.5	183	4
179	Kendari	Kr. Generaal Pel	03-09-10S	122-30-46E	10	Offshore	25	102	3
180	Kendari	Kr. Langara Bugis	04-01-19S	122-59-22E	10	Offshore	10	285	5
181	Kendari	Kr. Lingoro	03-58-59S	122-48-51E	10	Offshore	35	31	2
182	Kendari	Kr. P. Basa	04-52-00S	121-31-30E	10	Offshore	17.5	183	4
183	Kendari	Kr. P. Randa	04-36-34S	122-43-30E	10	Offshore	26	94	3
184	Kendari	Kr. Pel. Raha	04-50-54S	122-44-41E	10	Offshore	21	148	3
185	Kendari	Kr. Pomalaa	04-07-00S	121-32-24E	10	Offshore	15	231	4
186	Kendari	Kr. Raha	04-50-48S	122-44-20E	10	Offshore	11	276	5
187	Kendari	Kr. Rintang Selatan	03-17-04S	122-28-59E	10	Offshore	17.5	183	4
188	Kendari	Kr. Rosa Marie	04-05-30S	121-08-41E	10	Offshore	20	155	3
189	Kendari	Kr. Runduma	05-24-23S	124-24-20E	10	Offshore	27.5	69	3
190	Kendari	Kr. Selat Masiri	05-39-20S	121-37-00E	10	Offshore	35	31	2
191	Kendari	Kr. Selatan	03-45-45S	122-31-10E	10	Offshore	27.5	69	3
192	Kendari	Kr. Selatan Kaledupa	05-56-42S	123-47-06E	10	Offshore	17.5	183	4
193	Kendari	Kr. Selatan Kapota	05-35-03S	123-29-25E	10	Offshore	25	102	3
194	Kendari	Kr. Teluk Lemobajo	03-42-00S	122-20-10E	10	Offshore	10	285	5
195	Kendari	Kr. Tg. Barat Laut Kaledupa	05-31-42S	123-41-30E	10	Offshore	15	231	4
196	Kendari	Kr. Timur (Oneete)	02-59-03S	122-18-41E	10	Offshore	17.5	183	4
197	Kendari	Kr. Timur Batumarimpih	03-05-20S	122-21-04E	10	Offshore	8.5	309	5
198	Kendari	Kr. Timur Tg. Wawobatu	04-02-09S	122-42-00E	10	Offshore	15	231	4
199	Kendari	Kr. Utara Kaledupa	05-36-20S	123-31-30E	10	Offshore	30	53	2
200	Kendari	Kr. Utara Kapota	05-27-34S	123-22-10E	10	Offshore	30	53	2

Appendix 1.1.7.
Development of Aids to Navigation in Master Plan
(Light Beacon)

No.	DISNAV	Location	Latitude	Longitude	Structure Height (GL:)	Site	Total Score	Priority	Phase
201	Kendari	Kr. Utara P. Papado	02-59-49S	122-18-51E	10	Offshore	12.5	259	5
202	Kendari	Kr. Utara Sel. Wowonii	04-04-59S	122-54-05E	10	Offshore	22.5	125	3
203	Kendari	Kr. Utara Tg. Teipa	03-41-09S	122-25-46E	10	Offshore	12.5	259	5
204	Kendari	Kr.P.Hoga	05-26-49S	123-45-20E	10	Offshore	25	102	3
205	Kendari	Kr.Utara Lapuko	04-08-57S	122-41-30E	10	Offshore	10	285	5
206	Kendari	P. Damalawa Kcl.	05-19-09S	122-03-28E	10	Offshore	12.5	259	5
207	Kendari	P. Sangurabangi	05-19-35S	119-20-15E	20	On Land	25	102	3
208	Kendari	P. Togomongolo	03-13-17S	122-38-20E	10	On Land	35	40	2
209	Kendari	Pel. Lasalimu	05-14-14S	123-09-20E	10	Offshore	17.5	183	4
210	Kendari	Pel. Lasalimu	05-14-30S	123-09-00E	10	Offshore	10	285	5
211	Kendari	Pel. Mandiodo	03-34-13S	122-11-56E	20	On Land	8.5	309	5
212	Kendari	Pel. Mawasangka	05-18-15S	122-15-17E	10	Offshore	15	231	4
213	Kendari	Tg. Barat Papado	02-59-43S	122-19-00E	10	Offshore	10	285	5
214	Kendari	Tg. Batu Kala	02-52-00S	121-00-00E	30	On Land	10	285	5
215	Kendari	Tg. Batu Manu	02-55-24S	122-19-13E	20	On Land	15	231	4
216	Kendari	Tg. Kalandria	05-22-19S	122-37-15E	20	On Land	20	155	4
217	Makassar	Jampea	07-49-00S	120-25-46E	10	Offshore	32.5	41	2
218	Makassar	Jampea	07-49-59S	120-25-22E	10	Offshore	28.5	63	3
219	Makassar	Kr. Melintang	04-43-00S	120-27-00E	10	Offshore	17.5	183	4
220	Makassar	Kr. P. P. Takabonerate	06-48-29S	121-16-00E	30	On Land	27.5	69	3
221	Makassar	Kr. Taka Rangkap	05-40-45S	120-16-59E	10	Offshore	26	94	3
222	Makassar	Kr. Ug. Pepe	05-36-50S	119-29-30E	10	Offshore	17.5	183	4
223	Makassar	Kr.Laubang	04-01-14S	119-36-52E	10	Offshore	18	182	4
224	Makassar	Kr.P.Saujung	07-32-30S	117-31-00E	10	Offshore	40	16	2
225	Makassar	Kr.Tete	04-07-09S	119-36-46E	10	On Land	20	155	3
226	Makassar	Kr.Tg.Tonrangang	04-03-15S	119-36-46E	10	Offshore	17.5	183	4
227	Makassar	P. Karompacadi	07-13-59S	121-45-41E	30	On Land	28.5	63	3
228	Makassar	P. Lamuruang	07-18-29S	118-07-00E	20	On Land	22.5	125	3
229	Makassar	P. Libukang	05-38-54S	119-36-05E	20	On Land	18.5	173	4
230	Makassar	P. Makaranangana	06-43-14S	118-57-30E	10	On Land	27.5	69	3
231	Makassar	P. Marasende	05-07-30S	118-09-00E	20	On Land	31	47	2
232	Makassar	P. MnuKang	06-55-59S	118-52-00E	10	On Land	27.5	69	3
233	Makassar	P. Sambarjaga	07-05-44S	118-14-30E	20	On Land	27.5	69	3
234	Makassar	P. Tampaang	07-22-09S	117-45-00E	20	On Land	27.5	69	3
235	Makassar	Pel.Awerange	04-13-54S	119-35-51E	10	Offshore	21	148	3
236	Makassar	Pel.Palopa	02-59-04S	120-13-00E	20	On Land	11	276	5
237	Makassar	Pel.Serayar	06-06-57S	119-26-18E	20	On Land	30	53	3
238	Makassar	Polewali	03-29-08S	119-18-51E	10	Offshore	16	220	4
239	Makassar	Polewali	03-29-09S	119-18-25E	10	Offshore	16	220	4
240	Makassar	Tg. Appatana	06-30-00S	120-29-30E	10	Offshore	30	53	2

Appendix 1.1.7.
Development of Aids to Navigation in Master Plan
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No.	DISNAV	Location	Latitude	Longitude	Structure Height (GL:)	Site	Total Score	Priority	Phase
241	Makassar	Tg. Labua	05-20-30S	120-24-15E	30	On Land	10	285	5
242	Makassar	Tg. Salangketo	04-50-15S	120-22-59E	30	On Land	12.5	259	5
243	Makassar	Tg. Sarupo	03-43-00S	119-27-00E	30	On Land	8.5	309	5
244	Makassar	Tg. Suramana	00-50-44S	119-33-30E	30	On Land	15	231	4
245	Kupang	Alur Pelab. Balauring	08-14-20S	123-41-59E	10	Offshore	8.5	309	5
246	Kupang	Alur Pelab. Balauring	08-14-09S	123-41-55E	10	Offshore	16	220	4
247	Kupang	Balauring	08-14-30S	123-42-46E	20	On Land	8.5	309	5
248	Kupang	Barat daya Pade	08-30-23S	119-52-37E	20	On Land	16	220	4
249	Kupang	Bokin-Soe	09-50-09S	124-46-20E	20	On Land	15	231	4
250	Kupang	Kiniwai Laratarne	09-45-39S	119-20-46E	20	On Land	17.5	183	4
251	Kupang	Labuhan bajo	07-58-00S	119-47-06E	10	Offshore	25	102	3
252	Kupang	Labuhan bajo	08-26-43S	119-50-08E	10	Offshore	21	148	3
253	Kupang	Mananga	08-26-07S	123-05-25E	20	On Land	20	155	3
254	Kupang	Nangalill-Ruteng	08-47-25S	120-07-59E	20	On Land	8.5	309	5
255	Kupang	P.Sukur	08-07-09S	122-07-10E	10	Offshore	17.5	183	4
256	Kupang	Pel. Aimere	08-50-30S	120-51-06E	20	On Land	18.5	173	4
257	Kupang	Pelab. Walngapu	09-37-50S	120-15-45E	10	Offshore	17	216	4
258	Kupang	Pelab. Walngapu	09-37-23S	120-15-12E	10	Offshore	17	217	4
259	Kupang	Tg. Kumba	08-16-30S	124-23-51E	10	On Land	24	118	3
260	Kupang	Tg. Tutunnila	07-33-29S	126-37-00E	10	On Land	22.5	125	3
261	Kupang	Tg. Uwakeka	08-39-20S	127-22-30E	20	On Land	27.5	69	3
262	Kupang	Tg.Batu putih	08-31-35S	119-50-53E	20	On Land	15	231	4
263	Kupang	Tg.Batuata	09-36-56S	120-28-18E	10	On Land	20	155	4
264	Kupang	Tg.Kumba	08-15-24S	124-24-00E	30	On Land	14.5	248	4
265	Kupang	Tg.Wokar	08-44-53S	122-12-20E	10	On Land	10	285	5
266	Kupang	Trong	08-23-30S	123-08-30E	10	On Land	11	276	5
267	Ambon	Pel.Tobelo	01-43-22S	128-01-43E	10	Offshore	18.5	173	4
268	Ambon	Pel.Tobelo	01-43-30N	128-01-19E	10	Offshore	22.5	125	3
269	Ambon	Pel.Tobelo	01-43-32N	128-00-49E	10	Offshore	17.5	183	4
270	Ambon	Pel.Tobelo	01-43-36N	128-00-44E	10	Offshore	17.5	183	4
271	Ambon	Pu. Krus	05-34-59S	132-39-56E	10	Offshore	20	155	4
272	Ambon	Tg.Karbau	03-16-24S	127-07-20E	10	Offshore	21	148	3
273	Jayapura	Kr.Jaunan	03-06-00S	135-31-59E	10	Offshore	13.5	250	4
274	Jayapura	P.Ayawi	00-12-24S	134-58-51E	20	On Land	27.5	69	3
275	Jayapura	P.Isomanai	01-56-48S	139-00-25E	20	Offshore	8.5	309	5
276	Jayapura	P.Mengge	02-12-29S	139-31-59E	20	On Land	8.5	309	5
277	Jayapura	P.Miosindi	01-31-29S	135-49-55E	20	On Land	22.5	125	3
278	Jayapura	P.Miospandi	00-37-45S	135-29-10E	20	On Land	23.5	119	3
279	Jayapura	P.Nutabari	03-06-29S	135-09-03E	30	On Land	13.5	250	4
280	Jayapura	P.Roon	02-26-36S	124-33-43E	30	On Land	10	285	5

Appendix 1.1.7.
Development of Aids to Navigation in Master Plan
(Light Beacon)

No.	DISNAV	Location	Latitude	Longitude	Structure Height (GL:)	Site	Total Score	Priority	Phase
281	Jayapura	P.Rurbas Beba	01-18-29S	136-12-30E	20	On Land	27.5	69	3
282	Jayapura	P.Wairundi	01-10-45S	134-25-30E	20	On Land	23.5	119	3
283	Jayapura	Pel.Bosnik	01-10-19S	136-13-32E	20	On Land	17.5	183	4
284	Jayapura	Sorido	01-11-42S	136-05-59E	10	On Land	22.5	125	3
285	Jayapura	Sorido	01-11-51S	136-06-03E	10	On Land	17.5	183	4
286	Jayapura	Tg. Abwari	01-14-09S	136-38-10E	20	On Land	15	231	4
287	Jayapura	Tg. Mangguar	02-53-30S	134-51-20E	30	On Land	10	285	5
288	Jayapura	Tg. Riarwepam	02-10-00S	134-21-30E	30	On Land	11	276	5
289	Jayapura	Tg. Yobi	01-42-29S	136-56-59E	20	On Land	22.5	125	3
290	Jayapura	Tg.Arrareni	01-53-39S	136-32-46E	30	On Land	20	155	4
291	Jayapura	Tg.Nube	00-51-33S	136-03-03E	20	On Land	23.5	119	3
292	Jayapura	Tg.Praisbari	00-41-30S	135-48-46E	20	On Land	17.5	183	4
293	Jayapura	Tg.Rimon	00-52-59S	135-38-30E	20	On Land	11	276	5
294	Jayapura	Tg.S.Apauwar	01-38-25S	138-11-27E	30	On Land	13.5	250	5
295	Jayapura	Tg.Tanah Merah	02-23-44S	140-20-59E	30	On Land	17.5	183	4
296	Jayapura	Tg.Tmbieri	00-36-47S	135-23-30E	20	On Land	18.5	173	4
297	Jayapura	TgAyami	02-16-59S	134-34-00E	30	On Land	12.5	259	5
298	Jayapura	Waren	02-14-54S	136-22-46E	20	On Land	18.5	173	4
299	Sorong	Bintuni	02-15-42S	133-39-09E	20	On Land	9	304	5
300	Sorong	Daram	02-08-49S	130-53-25E	30	On Land	17.5	183	4
301	Sorong	Fuilu	01-21-45S	130-14-10E	30	On Land	17.5	183	4
302	Sorong	Gs. Masmasbus	01-57-39S	130-46-15E	10	Offshore	17.5	183	4
303	Sorong	Kr.P.Tubiserang	02-57-35S	132-18-24E	10	On Land	14.5	248	4
304	Sorong	Kr.Selat Sele	01-02-35S	131-11-22E	10	On Land	17.5	183	4
305	Sorong	P.Sagin	03-52-45S	133-55-00E	20	On Land	18.5	173	4
306	Sorong	P.Wayam	00-23-44S	131-15-10E	30	On Land	17.5	183	4
307	Sorong	Tg. Sekar	02-40-54S	132-25-10E	30	On Land	13.5	250	4
308	Sorong	Tg.Dore	00-42-29S	131-34-00E	20	On Land	23.5	119	3
309	Sorong	Tg.Dore	00-43-45S	131-32-18E	30	On Land	23.5	119	3
310	Sorong	Tg.Monfafa	00-07-05S	131-20-12E	20	On Land	17.5	183	4
311	Sorong	Tg.Mupi	01-01-59S	134-04-02E	30	On Land	12.5	259	5
312	Sorong	Tg.Nasaulang	04-04-59S	132-53-10E	30	On Land	17.5	183	4
313	Sorong	Tg.Opmarai	00-23-09S	132-16-00E	20	On Land	8.5	309	5
314	Sorong	Tg.Poweri	03-40-36S	133-44-10E	10	On Land	16	220	4
315	Sorong	Tg.Saweba	00-42-45S	133-56-46E	20	On Land	18.5	173	4
316	Sorong	Tg.Tongerai	03-38-20S	132-43-00E	20	On Land	11	276	5
317	Sorong	Tg.Wariai	00-01-30S	131-02-35E	20	On Land	11	276	5
318	Sorong	Tg.Wibain	00-43-59S	133-44-46E	20	On Land	12.5	259	5
319	Merauke	Gs.Triton	05-58-40S	138-03-20E	10	Offshore	16	220	4
320	Merauke	Ma.S. Sawaerma	05-30-39S	138-01-20E	10	Offshore	16	220	4

Appendix 1.1.7.
Development of Aids to Navigation in Master Plan
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No.	DISNAV	Location	Latitude	Longitude	Structure Height (GL:)	Site	Total Score	Priority	Phase
321	Merauke	Ma.S.Kumbe	08-21-26S	140-13-51E	10	On Land	19	171	4
322	Merauke	Ma.S.Kumbe	08-21-15S	140-14-07E	20	On Land	11.5	274	5

Appendix 1.3.1.
Present Condition of Vessels and Related Plan

As of July 31, 2001

1	ATN Office	Name of Ship	Class	Type	Built Year	Age	GRT (GT)	Technical Condition	Scrapping Plan (DGSC)	Rehabilitation Plan (DGSC)	Remarks
1	Sabang	KN Antares	I	AT	1999	2	550.00	100%			
2		KN B-133	III	AT	1965	36	34.08	65%	○		**
3	Belawan	KN Arcturus	I	AT	1999	2	550.00	92.93%			
4		KN Suar-008	III	AT	1973	28	--	61.74%		○	
5		KN B-118	III	AT	1961	40	45.10	51.41%	○		**
6	Sibolga	KN Altair	I	AT	1999	2	550.00	100%			
7	Dumai	KN Karakata	I	BT	1972	29	589.10	85%			
8		KN Mitra-III	III	AT	1975	26	50.00	71%		○	
9		KN Suar-006	III	AT	1973	28	--	63%		○	
10		KN AE-025	III	IB	1969	32	82.65	55%	○		**
11		KN Dudat D-045	III	AT	1953	48	83.51	59%	○		
12	Tg. Pinang	KN Adhara	I	AT	1999	2	550.00	100%			
13		KN Pari	I	BT	1978	23	644.46	61.70%		◎	
14		KN Mitra IV	III	AT	1975	26	65.00	54.40%		○	
15		KN Suar-004	III	AT	1971	30	--	60.68%		○	
16		KN Mantang	III	IB	2000	1	30.00	100%			
17	Tlk. Bayur	KN Muci	I	AT	1975	26	698.83	61.10%		◎	
18	Palembang	KN Daik (D-044)	III	AT	1953	48	65.19	50%	○		
19		KN Data D-047	III	AT	1953	48	57.97	65.76%	○		***
20		KN Suar-001	III	AT	1951	50	36.12	59.99%	○		
21		KN AE-028	III	IB	1969	32	59.02	64.44%		○	
22		KN B-125	III	AT	1961	40	34.54	57.13%	○		**
23	Tg. Priok	KN Pamancasa	I	AT	1978	23	904.52	60.00%		◎	
24		KN Permata	I	AT	1953	48	684.89	46.21%	○		*
25		KN Mitra-I	III	AT	1960	41	75.00	62.97%	○		
26		KN Suar-014	III	AT	1980	21	108.58	42.64%		○	
27		KN AP-027	IV	AT	1966	35	46.67	56.41%	○		**
28		KN AB-P3	IV	AT	1971	30	8.16	58.11%	○		**
29	Semarang	KN B-126	III	AT	1961	40	34.01	61.35%	○		**
30		KN Suar-011	III	AT	1980	21	--	53.92%		○	
31		KN B-008	III	AT	1945	56	39.63	58.53%	○		
32		KN B-124	III	AT	1961	40	44.37	54.92%	○		**
33	Cilacap	KN Suar-005	III	AT	1971	30	--	70.21%		○	
34		KN Suar-007	III	AT	1973	28	--	68.70%		○	
35	Surabaya	KN Prajapati	I	BT	1979	22	684.68	67.95%		◎	
36		KN Mandalika	I	AT	1975	26	767.62	54.54%		◎	
37		KN Damara	III	AT	1953	48	72.98	59.23%	○		
38		KN Suar-002	III	AT	1951	50	--	59.55%	○		
39		KN AE-029	III	IB	1969	32	82.65	59.47%		○	
40	Benoa	KN Mizan	I	AT	1996	5	257.20	98%			
41		KN Boga	II	AT	1952	49	194.34	60%	○		***
42	Pontianak	KN Balam	II	AT	1952	49	192.87	44%	○		***
43		KN AE-012	III	IB	1967	34	47.99	58%		○	
44	Banjarmasin	KN Bido	II	AT	1952	49	194.34	50.12%	○		*
45		KN Suar-003	III	AT	1971	30	--	58%		○	
46		KN AE-032	III	IB	1971	30	82.65	76.75%		○	
47		KN Mokmer	III	IB	1999	2	37.00	97.95%			
48	Samarinda	KN Mithuna	I	BT	1975	26	644.23	57%		◎	
49		KN Dagong	III	AT	1953	48	79.22	39%	○		
50		KN Suar-010	III	AT	1975	26	--	62%		○	
51		KN Marapas	III	IB	1999	2	37.00	100%			
52	Tarakan	KN Blekok	II	AT	1952	49	191.50	41%	○		*
53		KN Duku (D-043)	III	AT	1953	48	77.52	49%	○		***
54	Bitung	KN Merak	I	AT	1996	5	257.20	89.59%			
55		KN Suar-009	III	AT	1974	27	49.71	62.75%		○	
56		KN B-134	III	AT	1964	37	34.68	67.49%		○	
57	Kendari	KN Barau	II	AT	1952	49	192.87	41%		○	
58	Makassar	KN Mengkara	I	AT	1996	5	257.20	73.98%			
59		KN Mitra II	III	AT	1960	41	150.00	55.10%	○		
60		KN B-120	III	AT	1961	40	41.38	60%	○		**
61	Kupang	KN Mina	I	AT	1997	4	257.20	98%			
62		KN Dingki D-045	III	AT	1953	48	79.22	51%	○		
63	Ambon	KN Mayang	I	AT	1996	5	257.20	98%			
64	Jayapura	KN Aldebaran	I	AT	1999	2	550.00	100%			
65		KN TNH. Merah	II	AT	1966	35	142.96	64%		○	
66		KN EJS Rmainum	IV	IB	1972	29	84.45	60%		○	
67	Sorong	KN Mahkota	I	AT	1997	4	257.20	98%			
68		KN Pradawana	I	BT	1979	22	762.78	85%			
69		KN Raja Ampat	II	IB	1954	47	397.79	36%	○		
70		KN S.Kaibus	IV	AT	1955	46	29.57	50%	○		
71	Merauke	KN Merpati	I	AT	1997	4	257.20	98%			
72		KN Tlk Kabare	III	IB	1962	39	207.50	61%	○		
73		KN Bintanggor	IV	IB	1967	34	133.08	73%		○	
74	B T K P	KN Bimasakti	I	SV	1984	17	1,373.00	82%			
75		KN Kumba	I	BT	1972	29	589.23	60%		◎	

Note: * shows to be scrapped in year of 2002
** shows that scrapping should be postponed until 2007 at least.
*** shows that DGSC have a repair plan.
◎ shows first priority

"BT" means Buoy Tender.
"AT" means Aids Tender.
"IB" means Inspection Boat
"SV" means Survey Vessel.

Appendix 1.3.2.
Proposed Scrap and Rehabilitation Plan of Vessels

1	ATN Office	Name of Ship	Class / Type	Built Year	Age	GRT (GT)	Technical Condition	2002	Up to 2005	Up to 2010	Up to 2015	Up to 2020
1	Sabang	KN Antares	I AT	1999	2	550.00	100%					
2		KN B-133	III AT	1965	36	34.08	65%		○ →	○	●	
3	Belawan	KN Arcturus	I AT	1999	2	550.00	92.93%					
4		KN suar-008	III AT	1973	28	--	61.74%		○			●
5		KN B-118	III AT	1961	40	45.10	51.41%			●		
6	Sibolga	KN Altair	I AT	1999	2	550.00	100%					
7	Dumai	KN Karakata	I BT	1972	29	589.10	85%		○ →	○		●
8		KN Mitra-III	III AT	1975	26	50.00	71%		○ →	○		
9		KN Suar-006	III AT	1973	28	--	63%		○			●
10		KN AE-025	III IB	1969	32	82.65	55%		○		●	
11		KN Dudat D-045	III AT	1953	48	83.51	59%		●			
12	Tg. Pinang	KN Adhara	I AT	1999	2	550.00	100%					
13		KN Pari	I BT	1978	23	644.46	61.70%		◎ ←	◎		
14		KN Mitra IV	III AT	1975	26	65.00	54.40%		○			
15		KN Suar-004	III AT	1971	30	--	60.68%		○			●
16		KN Mantang	III IB	2000	1	30.00	100%					
17	Tlk. Bayur	KN Muci	I AT	1975	26	698.83	61.10%		◎			
18	Palembang	KN Daik (D-044)	III AT	1953	48	65.19	50%		●			
19		KN Data D-047	III AT	1953	48	57.97	65.76%		*	●		
20		KN Suar-001	III AT	1951	50	36.12	59.99%		●			
21		KN AE-028	III IB	1969	32	59.02	64.44%		○ →	○	●	
22		KN B-125	III AT	1961	40	34.54	57.13%			●		
23	Tg. Priok	KN Pamancasa	I AT	1978	23	904.52	60.00%		◎ ←	◎		
24		KN Permata	I AT	1953	48	684.89	46.21%	●				
25		KN Mitra- I	III AT	1960	41	75.00	62.97%			●		
26		KN Suar-014	III AT	1980	21	108.58	42.64%			○		
27		KN AP-027	IV AT	1966	35	46.67	56.41%		○		●	
28		KN AB-P3	IV AT	1971	30	8.16	58.11%		○			●
29	Semarang	KN B-126	III AT	1961	40	34.01	61.35%			●		
30		KN Suar-011	III AT	1980	21	--	53.92%			○		
31		KN B-008	III AT	1945	56	39.63	58.53%		●			
32		KN B-124	III AT	1961	40	44.37	54.92%			●		
33	Cilacap	KN Suar-005	III AT	1971	30	--	70.21%		○ →	○		●
34		KN Suar-007	III AT	1973	28	--	68.70%		○ →	○		●
35	Surabaya	KN Prajapati	I BT	1979	22	684.68	67.95%		◎ ←	◎		
36		KN Mandalika	I AT	1975	26	767.62	54.54%		◎			
37		KN Damara	III AT	1953	48	72.98	59.23%		●			
38		KN Suar-002	III AT	1951	50	--	59.55%		●			
39		KN AE-029	III IB	1969	32	82.65	59.47%		○		●	
40	Benoa	KN Mizan	I AT	1996	5	257.20	98%					
41		KN Boga	II AT	1952	49	194.34	60%		*	●		
42	Pontianak	KN Balam	II AT	1952	49	192.87	44%		*	●		
43		KN AE-012	III IB	1967	34	47.99	58%		○		●	
44	Banjarmasin	KN Bido	II AT	1952	49	194.34	50.12%	●				
45		KN Suar-003	III AT	1971	30	--	58%		○			●
46		KN AE-032	III IB	1971	30	82.65	76.75%		○ →	○		●
47		KN Mokmer	III IB	1999	2	37.00	97.95%					
48	Samarinda	KN Mithuna	I BT	1975	26	644.23	57%		◎			
49		KN Dagong	III AT	1953	48	79.22	39%		●			
50		KN Suar-010	III AT	1975	26	--	62%		○			
51		KN Marapas	III IB	1999	2	37.00	100%					
52	Tarakan	KN Blekok	II AT	1952	49	191.50	41%	●				
53		KN Duku (D-043)	III AT	1953	48	77.52	49%		*	●		
54	Bitung	KN Merak	I AT	1996	5	257.20	89.59%					
55		KN Suar-009	III AT	1974	27	49.71	62.75%		○			●
56		KN B-134	III AT	1964	37	34.68	67.49%			●		
57	Kendari	KN Barau	II AT	1952	49	192.87	41%		●			
58	Makassar	KN Mengkara	I AT	1996	5	257.20	73.98%					
59		KN Mitra II	III AT	1960	41	150.00	55.10%			●		
60		KN B-120	III AT	1961	40	41.38	60%			●		
61	Kupang	KN Mina	I AT	1997	4	257.20	98%					
62		KN Dingki D-045	III AT	1953	48	79.22	51%		●			
63	Ambon	KN Mayang	I AT	1996	5	257.20	98%					
64	Jayapura	KN Aldebaran	I AT	1999	2	550.00	100%					
65		KN TNH. Merah	II AT	1966	35	142.96	64%		○ →	○	●	
66		KN EJS Rmainum	IV IB	1972	29	84.45	60%		○			●
67	Sorong	KN Mahkota	I AT	1997	4	257.20	98%					
68		KN Pradawana	I BT	1979	22	762.78	85%			○		
69		KN Raja Ampat	II IB	1954	47	397.79	36%		●			
70		KN S.Kaibus	IV AT	1955	46	29.57	50%		●			
71	Merauke	KN Merpati	I AT	1997	4	257.20	98%					
72		KN Tk. Kabare	III IB	1962	39	207.50	61%			●		
73		KN Bintanggor	IV IB	1967	34	133.08	73%		○ →	○	●	
74	B T K P	KN Bimasakti	I SV	1984	17	1,373.00	82%				○	
75		KN Kumba	I BT	1972	29	589.23	60%		◎			●

Note "BT", "AT", "IB" and "SV" means "Buoy Tender", "Aids Tender", "Inspection Boat" and "Survey Vessel", respectively.

● shows to be time of scrapping ○ shows to be time of rehabilitation

＊ shows to be repaired ◎ shows to be time of rehabilitation with first priority.

Appendix 1.3.3.

Workload Calculation and Number of Aids Tender & Inspection Boat required up to Year 2007

No.	ATN Office	Class	Total Mile in 2001	Light House				Light Beacon				Increase ratio at 2007	Total Mile in 2007	For Sailing								Work at Site							Total days	Margin (10%)	Work load (Days)	Number of vessels to be required:	
				Existing	On going	2003-2007	2007 Total	Existing	On going	2003-2007	2007 Total			F	P	SP	L	H/Days	V	PO	Days	Lighthouse			Light Beacon			Sub-total					
																						LS	MM	Days	SM	MM	Days					A/T	IB
1	SABANG	Sub	1,002	9	0	0	9	31	0	0	31	0.0%	1,002	12	2	4	1,002	24	9	2	152	27	3	30	30	4	34	64	216	22	238	1	1
2	BELAWAN	II	661	5	0	0	5	45	0	0	45	0.0%	661	12	2	4	661	24	9	2	133	15	2	17	43	6	49	66	199	20	219	1	1
3	SIBOLGA	Sub	734	7	0	0	7	46	0	0	46	0.0%	734	12	2	4	734	24	9	2	137	21	2	23	44	6	50	73	210	21	231	1	1
4	DUMAI	I	1,031	5	0	0	5	34	0	7	41	17.9%	1,216	12	2	4	1,216	24	9	2	164	15	2	17	39	6	45	62	226	23	249	1	1
5	TG. PINANG	I	1,692	22	1	3	26	71	3	7	81	15.1%	1,947	12	2	4	1,947	24	9	2	205	77	7	84	76	11	87	171	376	38	414	1	1
6	TLK. BAYUR	II	915	8	0	0	8	40	0	0	40	0.0%	915	12	2	4	915	24	9	2	147	24	2	26	38	5	43	69	216	22	238	1	1
7	PALEMBANG	II	1,127	4	0	3	7	63	0	5	68	11.9%	1,262	12	2	4	1,262	24	9	2	167	21	2	23	64	9	73	96	263	27	290	1	1
8	TG.PRIOK	I	3,043	27	0	0	27	96	2	3	101	4.1%	3,167	12	2	4	3,167	24	9	2	272	80	7	87	95	13	108	195	467	47	514	1	1
9	SEMARANG	II	452	7	0	0	7	31	0	3	34	7.9%	488	12	2	4	488	24	9	2	124	21	2	23	32	5	37	60	184	19	203	1	1
10	CILACAP	Sub	373	6	0	0	6	17	0	0	17	0.0%	373	12	2	4	373	24	9	2	117	18	2	20	16	3	19	39	156	16	172	1	1
11	SURABAYA	I	1,625	19	0	1	20	58	0	2	60	3.9%	1,688	12	2	4	1,688	24	9	2	190	59	5	64	57	8	65	129	319	32	351	1	1
12	BENOA	II	1,609	15	0	1	16	57	0	0	57	1.4%	1,631	12	2	4	1,631	24	9	2	187	47	4	51	54	8	62	113	300	30	330	1	1
13	PONTIANAK	Sub	980	3	1	0	4	42	1	0	43	4.4%	1,024	12	2	4	1,024	24	9	2	153	12	1	13	41	6	47	60	213	22	235	1	1
14	BANJARMASIN	II	1,205	7	0	0	7	38	1	0	39	2.2%	1,232	12	2	4	1,232	24	9	2	165	21	2	23	37	5	42	65	230	23	253	1	1
15	SAMARINDA	I	754	5	0	0	5	48	0	0	48	0.0%	754	12	2	4	754	24	9	2	138	15	2	17	45	6	51	68	206	21	227	1	1
16	TARAKAN	II	534	2	0	0	2	24	0	0	24	0.0%	534	12	2	4	534	24	9	2	126	6	1	7	23	3	26	33	159	16	175	1	1
17	BITUNG	I	3,180	21	0	0	21	84	2	4	90	5.7%	3,362	12	2	4	3,362	24	9	2	283	62	6	68	85	12	97	165	448	45	493	2	1
18	KENDARI	Sub	1,358	6	0	0	6	62	0	0	62	0.0%	1,358	12	2	4	1,358	24	9	2	172	18	2	20	59	8	67	87	259	26	285	1	1
19	UJ.PANDANG	I	2,450	18	0	0	18	50	2	0	52	2.9%	2,522	12	2	4	2,522	24	9	2	237	53	5	58	49	7	56	114	351	36	387	1	1
20	KUPANG	II	1,887	13	4	0	17	48	8	0	56	19.7%	2,258	12	2	4	2,258	24	9	2	222	50	5	55	53	7	60	115	337	34	371	1	1
21	AMBON	I	3,340	12	5	0	17	71	4	0	75	10.8%	3,702	12	2	4	3,702	24	9	2	302	50	5	55	71	10	81	136	438	44	482	1	1
22	JAYAPURA	II	1,386	7	0	0	7	34	0	0	34	0.0%	1,386	12	2	4	1,386	24	9	2	173	21	2	23	32	5	37	60	233	24	257	1	1
23	SORONG	I	2,370	6	0	0	6	52	0	0	52	0.0%	2,370	12	2	4	2,370	24	9	2	228	18	2	20	49	7	56	76	304	31	335	1	1
24	MERAUKE	Sub	959	1	0	0	1	26	0	0	26	0.0%	959	12	2	4	959	24	9	2	150	3	1	4	25	4	29	33	183	19	202	1	1
TOTAL																																25	24

Note:

F: Frequency of Sailing
P: Days of Preparation
SP: Days of Sailing Preparation

L: Sailing Distance
V: Sailing Speed
PO: Post Operation

LS: Logistic Supply
SM: Standard Maintenance
MM: Major Maintenance (Overhaul)

A/T: Aids Tender
I/B: Inspection Boat

Appendix 1-3-4

Appendix 1.3.4.

Workload Calculation and Number of Aids Tender & Inspection Boat required up to Year 2020

No.	ATN Office	Class	Total Mile of in 2001	Light House				Light Beacon				Increase ratio at 2020	Total Mile in 2020	For Sailing								Work at Site							Total days	Margin (10%)	Work load (Days)
				Existing	On going	2003-2020	2020 Total	Existing	On going	2003-2020	2020 Total			F	P	SP	L	H / Days	V	PO	Days	Lighthouse			Light Beacon			Sub-total			
																						LS	MM	Days	SM	MM	Days				
1	SABANG	Sub	1,002	9	0	2	11	31	0	12	43	35.0%	1,353	12	2	4	1,353	24	9	2	172	33	3	36	41	6	47	83	255	26	281
2	BELAWAN	II	661	5	0	1	6	45	0	3	48	8.0%	714	12	2	4	714	24	9	2	136	18	2	20	45	6	51	71	207	21	228
3	SIBOLGA	Sub	734	7	0	0	7	46	0	17	63	32.1%	969	12	2	4	969	24	9	2	150	21	2	23	60	8	68	91	241	25	266
4	DUMAI	I	1,031	5	0	0	5	34	0	8	42	20.5%	1,242	12	2	4	1,242	24	9	2	166	15	2	17	40	6	46	63	229	23	252
5	TG.P.PINANG	I	1,692	22	1	7	30	71	3	20	94	33.3%	2,256	12	2	4	2,256	24	9	2	222	89	8	97	89	12	101	198	420	42	462
6	TLK.BAYUR	II	915	8	0	2	10	40	0	6	46	16.7%	1,068	12	2	4	1,068	24	9	2	156	30	3	33	44	6	50	83	239	24	263
7	PALEMBANG	II	1,127	4	0	5	9	63	0	10	73	22.4%	1,379	12	2	4	1,379	24	9	2	173	27	3	30	69	10	79	109	282	29	311
8	TG.P.RIOK	I	3,043	27	0	7	34	96	2	11	109	16.3%	3,538	12	2	4	3,538	24	9	2	293	100	9	109	103	14	117	226	519	52	571
9	SEMARANG	II	452	7	0	1	8	31	0	8	39	23.7%	559	12	2	4	559	24	9	2	128	24	2	26	37	5	42	68	196	20	216
10	CILACAP	Sub	373	6	0	0	6	17	0	3	20	13.0%	422	12	2	4	422	24	9	2	120	18	2	20	19	3	22	42	162	17	179
11	SURABAYA	I	1,625	19	0	2	21	58	0	7	65	11.7%	1,815	12	2	4	1,815	24	9	2	197	62	6	68	61	9	70	138	335	34	369
12	BENOA	II	1,609	15	0	5	20	57	0	3	60	11.1%	1,788	12	2	4	1,788	24	9	2	196	59	5	64	57	8	65	129	325	33	358
13	PONTIANAK	Sub	980	3	1	1	5	42	1	5	48	17.8%	1,154	12	2	4	1,154	24	9	2	161	15	2	17	45	6	51	68	229	23	252
14	BANJARMASIN	II	1,205	7	0	2	9	38	1	14	53	37.8%	1,660	12	2	4	1,660	24	9	2	189	27	3	30	50	7	57	87	276	28	304
15	SAMARINDA	I	754	5	0	4	9	48	0	4	52	15.1%	868	12	2	4	868	24	9	2	145	27	3	30	49	7	56	86	231	24	255
16	TARAKAN	II	534	2	0	1	3	24	0	4	28	19.2%	637	12	2	4	637	24	9	2	132	9	1	10	27	4	31	41	173	18	191
17	BITUNG	I	3,180	21	0	8	29	84	2	35	121	42.9%	4,543	12	2	4	4,543	24	9	2	349	86	8	94	114	16	130	224	573	58	631
18	KENDARI	Sub	1,358	6	0	3	9	62	0	46	108	72.1%	2,337	12	2	4	2,337	24	9	2	226	27	3	30	102	14	116	146	372	38	410
19	UJ.P.ANDANG	I	2,450	18	0	2	20	50	2	28	80	47.1%	3,603	12	2	4	3,603	24	9	2	297	59	5	64	75	10	85	149	446	45	491
20	KUPANG	II	1,887	13	4	7	24	48	8	22	78	67.2%	3,155	12	2	4	3,155	24	9	2	272	71	6	77	74	10	84	161	433	44	477
21	AMBON	I	3,340	12	5	18	35	71	4	6	81	39.8%	4,668	12	2	4	4,668	24	9	2	356	103	9	112	76	11	87	199	555	56	611
22	JAYAPURA	II	1,386	7	0	3	10	34	0	26	60	70.7%	2,366	12	2	4	2,366	24	9	2	228	30	3	33	57	8	65	98	326	33	359
23	SORONG	I	2,370	6	0	10	16	52	0	20	72	51.7%	3,596	12	2	4	3,596	24	9	2	296	47	4	51	68	9	77	128	424	43	467
24	MERAUKE	Sub	959	1	0	0	1	26	0	4	30	14.8%	1,101	12	2	4	1,101	24	9	2	158	3	1	4	29	4	33	37	195	20	215
TOTAL																															

Note:

F : Frequency of Sailing
P : Days of Preparation
SP : Days of Sailing Preparation
L : Sailing Distance
V : Sailing Speed
PO : Post Operation
LS : Logistic Supply
SM : Standard Maintenance
MM : Major Maintenance (Overhaul)
AT : Aids Tender
IB : Inspection Boat

Appendix 1.3.5.
Workload Calculation and Number of Buoy Tender required up to Year 2020

(1) Work Load at Year 2007 for Operation and Maintenance of Buoy

No.	ATN Office	Total Mile of in 2001	Number of Light Buoy				Increase ratio in 2007	Total Mile in 2007	For Sailing								Work at Site				Sub-total	Margin (10%)	Work load (Days)
			Existing	On going	2003-2007	2007 Total			F	P	SP	L	H/day	V	PO	Days	SM	MM	RP	Days			
4	DUMAI	1,900	85	28	6	119	40.0%	2,660	4.75	2	4	2,660	24	10	2	91	30	40	30	99	190	19	209
5	TG. PINANG	1,450	40	16	3	59	47.5%	2,139	4.75	2	4	2,139	24	10	2	80	15	20	15	49	130	13	143
8	TG.PRIOK	3,200	66	33	6	105	59.1%	5,091	4.75	2	4	5,091	24	10	2	139	26	35	26	88	227	23	250
11	SURABAYA	2,000	59	18	5	82	39.0%	2,780	4.75	2	4	2,780	24	10	2	93	21	27	21	68	162	17	179
15	SAMARINDA	2,650	41	13	3	57	39.0%	3,684	4.75	2	4	3,684	24	10	2	111	14	19	14	48	159	16	175
17	Bitung	520	7	0	0	7	0.0%	520	4.75	2	4	520	24	10	2	48	2	2	2	6	55	6	61
19	UJ.PANDANG	400	8	5	1	14	75.0%	700	4.75	2	4	700	24	10	2	52	4	5	4	12	64	7	71
21	AMBON	2,300	9	0	0	9	0.0%	2,300	4.75	2	4	2,300	24	10	2	84	2	3	2	8	92	10	102
23	SORONG	2,000	17	6	2	25	47.1%	2,941	4.75	2	4	2,941	24	10	2	96	6	8	6	21	118	12	130
Total																					1,197	123	1,320

1,320 days /215 days = 6.139535

Number of Buoy Tender to be required for operation and maintenance at year of 2007: 7units

(2) Work Load at Year 2020 for Operation and Maintenance of Buoy

No.	ATN Office	Total Mile of in 2001	Number of Light Buoy				Increase ratio in 2020	Total Mile in 2020	For Sailing								Work at Site				Sub-total	Margin (10%)	Work load (Days)
			Existing	On going	2003-2020	2020 Total			F	P	SP	L	H/day	V	PO	Days	SM	MM	RP	Days			
4	DUMAI	1,900	85	28	40	153	80.0%	3,420	4.75	2	4	3,420	24	10	2	106	38	51	38	128	234	24	258
5	TG. PINANG	1,450	40	16	20	76	90.0%	2,755	4.75	2	4	2,755	24	10	2	93	19	25	19	63	156	16	172
8	TG.PRIOK	3,200	66	33	33	132	100.0%	6,400	4.75	2	4	6,400	24	10	2	165	33	44	33	110	275	28	303
11	SURABAYA	2,000	59	18	27	104	76.3%	3,525	4.75	2	4	3,525	24	10	2	108	26	35	26	87	195	20	215
15	SAMARINDA	2,650	41	13	19	73	78.0%	4,718	4.75	2	4	4,718	24	10	2	131	18	24	18	61	193	20	213
17	Bitung	520	7	0	2	9	28.6%	669	4.75	2	4	669	24	10	2	51	2	3	2	8	59	6	65
19	UJ.PANDANG	400	8	5	5	18	125.0%	900	4.75	2	4	900	24	10	2	56	5	6	5	15	71	8	79
21	AMBON	2,300	9	0	3	12	33.3%	3,067	4.75	2	4	3,067	24	10	2	99	3	4	3	10	109	11	120
23	SORONG	2,000	17	6	8	31	82.4%	3,647	4.75	2	4	3,647	24	10	2	110	8	10	8	26	137	14	151
Total																					1429	147	1576

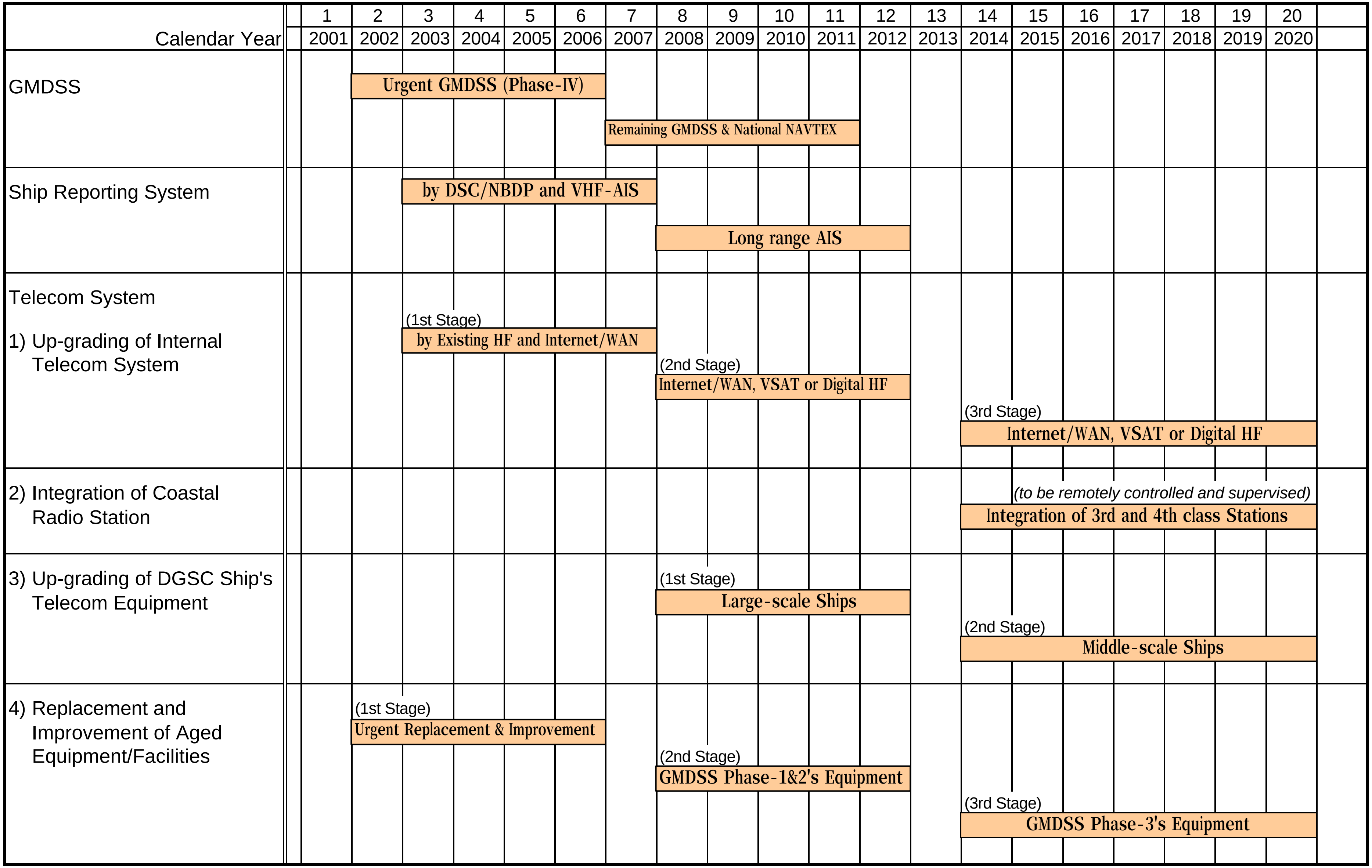
1,576 days /215 days = 7.330233

Number of Buoy Tender to be required for operation and maintenance at year of 2020: 8 units

Note:

F: Frequency of Sailing
P: Days of Preparation
SP: Days of Sailing Preparation
L: Sailing Distance
V: Sailing Speed
PO: Post Operation
SM: Standard Maintenance
MM: Major Maintenance (Overhaul)
RP: Replacement of Buoy

Appendix 1.5.1.
Implementation Schedule of Master Plan for Maritime Telecommunications System



Note: AIS; Automatic Identification System

Appendix 2.1.1.

Rehabilitation and Improvement of Visual Aids to Navigation in Short Term Plan (Light Beacon)

No.	DSI No.	Location	Construction Year	Age	Operation Status	Lantern Condition	Power Supply Condition	Structure Condition	DUP	Latitude	Longitude	Structure Height (GL:m)	DISNAV	Phase
1	150	Kuala Langsa	1980	21	0	0	0	0	1	04-32-41N	098-03-02	12	Belawan	1
2	160	Kuala Langsa	1980	21	0	0	0	0	1	04-33-08N	098-03-36	8	Belawan	1
3	180	Kuala Langsa	1980	21	0	0	0	0	1	04-33-33N	098-04-22	10	Belawan	1
4	190	Kuala Langsa	1980	21	0	0	0	0	1	04-33-01N	098-03-56	18	Belawan	1
5	390	Belawan Deli	1983	18	0	0	0	0	1	03-48-54N	098-43-00	5.5	Belawan	1
6	400	Belawan Deli	1983	18	0	0	0	0 (Collapsed)	1	03-48-06N	098-43-15	5.5	Belawan	1
7	410	Belawan Deli	1983	18	1	0	0	1	1	03-47-22N	098-43-38	12	Belawan	1
8	450	Sungai Nunang	1979	22	0	0	0	0 (Collapsed)	0	03-47-18N	098-40-46	10	Belawan	1
9	451	Sungai Nunang	1984	17	0	0	0	0 (Collapsed)	0	03-47-30N	098-40-42	10	Belawan	1
10	510	Tg.Tiram	1984	17	1	0	0	1	1	03-14-54N	099-35-19	10	Belawan	1
11	550	Bagan Asahan	1977	24	1	0	0	1	1	03-02-46N	099-51-56	15	Belawan	1
12	551	S Asahan Depan	1993	8	0	0	0	0 (Collapsed)	0	03-01-44N	099-51-40	10	Belawan	1
13	631	Morong	1979	22	1	1	1	0	0	01-55-10N	101-46-25	10	Dumai	3
14	650	Tg.Leban	1991	10	0	0	0	0	1	01-39-30N	101-50-30	10	Dumai	1
16	675	Selat Rupat C	1984	17	1	0	0	1	0	01-32-14N	101-54-33	30	Dumai	2
17	677	Selat Rupat E	1991	10	0	0	0	0	1	01-41-23N	101-48-09	20	Dumai	1
18	679	Selat Rupat G	1991	10	0	0	0	0	1	01-41-30N	101-47-53	20	Dumai	1
20	740	Sei Siak	1984	17	0	0	0	0 (Collapsed)	0	01-12-30N	102-10-00	10	Dumai	1
21	750	Sei Siak	1961	40	0	0	0	0	0	01-11-30N	102-09-30	10	Dumai	1
25	928	Tg.Bakau	1978	23	0	0	0	1	1	00-20-00S	103-47-30	10	Dumai	1
26	929	Tembilahan	1982	19	1	1	1	0	0	00-20-00S	103-09-18	10	Dumai	2
27	940	Speck Rock	1988	13	0	1	1	0	0	00-36-48N	104-06-06	10	Tg.Pinang	2
28	981	Mentigi	1983	18	0	1	1	1	0	01-03-45N	104-13-00	30	Tg.Pinang	2
29	1010	Tunjuk II	1975	26	1	1	1	0	0	00-56-26N	104-12-00	20	Tg.Pinang	2
30	1088	P.Kambat	1989	12	0	0	0	0 (Collapsed)	1	00-48-30N	104-39-54	10	Tg.Pinang	1
31	1112	Kr.Heluputan	1992	9	0	0	0	0 (Collapsed)	0	00-37-15N	105-08-30	10	Tg.Pinang	1
32	1160	S. Daik	1990	11	1	1	1	0	0	00-13-30N	104-78-00	10	Tg.Pinang	2
33	1170	Pelab. Penuba	1990	11	1	1	1	0	0	00-19-10N	104-27-50	10	Tg.Pinang	2
34	1180	Pelab. Dabo	1990	11	0	0	0	0 (Collapsed)	0	00-29-30S	104-33-30	10	Tg.Pinang	1
35	1190	P.Saya	1994	7	0	0	0	0 (Collapsed)	0	00-46-50S	104-55-58	20	Tg.Pinang	1
36	1270	Hendrik	1982	19	0	0	0	0	0	01-58-00S	104-57-10	20	Palembang	1
37	1271	Tg. Kampeh	1980	21	0	0	0	0 (Collapsed)	0	02-11-27S	104-54-04	20	Palembang	1
38	1300	Bak I	1996	5	1	0	0	0	1	02-13-11S	104-55-34	10	Palembang	1

Appendix 2.1.1.

Rehabilitation and Improvement of Visual Aids to Navigation in Short Term Plan (Light Beacon)

No.	DSI No.	Location	Construction Year	Age	Operation Status	Lantern Condition	Power Supply Condition	Structure Condition	DUP	Latitude	Longitude	Structure Height (GL:m)	DISNAV	Phase
39	1310	Bak II	1981	20	0	0	0	0 (Collapsed)	1	02-12-50S	104-55-42	20	Palembang	1
41	1682	Maspari	1986	15	0	0	0	0 (Collapsed)	0	03-13-08S	106-13-00	40	Tg. Priok	1
42	1684	Tg. Menjangan	1995	6	0	0	0	1	0	03-49-14S	106-00-03	10	Tg. Priok	1
43	1687	Tg. Bungin	1999	2	0	0	0	1	0	04-33-28S	106-03-29	10	Tg. Priok	1
44	1689	Gs. Serdang	1994	7	0	0	0	1	0	05-04-30S	106-16-36	10	Tg. Priok	1
45	1700	Beting Raja	1971	30	1	0	0	0	0	05-12-30S	106-44-20	10	Tg. Priok	2
46	1708	Tg. Priok	1993	8	0	0	0	0 (Collapsed)	0	06-05-41S	106-52-40	10	Tg. Priok	1
47	1710	Beting Eka	1792		0	0	0	0 (Collapsed)	1	05-17-32S	106-54-30	10	Tg. Priok	1
48	1740	Tg. Kerawang	1979	22	0	0	0	0 (Collapsed)	1	05-54-18S	107-00-28	10	Tg. Priok	1
49	1751	P. Putri	1983	18	0	0	0	0	0	06-04-07S	106-51-18	10	Tg. Priok	1
50	1752	Kr. Lamteri	1983	18	0	0	0	0	0	06-04-25S	106-49-50	10	Tg. Priok	1
51	1820	Pel. Pertamina	1982	19	0	0	0	0	0	06-05-49S	105-53-41	10	Tg. Priok	1
52	1821	Pel. Pertamina	1982	19	0	0	0	0 (Collapsed)	0	06-05-38S	106-54-18	10	Tg. Priok	1
53	1822	Pel. Pertamina	1982	19	0	0	0	0 (Collapsed)	0	06-05-51S	106-54-14	10	Tg. Priok	1
54	1823	Pel. Pertamina	1985	16	0	0	0	0 (Collapsed)	0	06-05-40S	106-53-41	10	Tg. Priok	1
55	1831	Kr. Belikat	1995	6	0	0	0	1	0	02-28-00S	106-58-20	20	Palembang	1
56	1910	Tg. Pandang	1973	28	0	0	0	0 (Collapsed)	0	02-44-10S	107-35-42	10	Tg. Priok	1
57	1911	Kr. Tanjung Panda	1993	8	0	0	0	0 (Collapsed)	0	02-43-58S	107-35-30	10	Palembang	1
58	1916	Magdalena	1994	7	0	0	0	0 (Collapsed)	0	02-01-18S	106-32-24	10	Palembang	1
59	1950	Pangkal baran depa	1979	22	0	0	0	0	0	02-05-40S	106-09-57	20	Palembang	1
60	1970	Fox Bank	1989	12	1	0	0	1	1	03-30-40S	110-11-00	10	Tg. Priok	1
61	2010	Kanis	1973	28	0	0	0	0 (Collapsed)	0	02-37-18S	108-12-20	10	Tg. Priok	1
62	2037	S. Datu Belakang	1991	10	1	1	1	0	0	00-07-35S	108-36-40	30	Pontianak	2
63	2041	Telok Air	1995	6	0	0	0	0 (Collapsed)	0	00-40-54S	109-22-10	10	Pontianak	1
64	2042	Telok Air	1997	4	0	0	0	0 (Collapsed)	0	00-12-32S	109-23-50	10	Pontianak	1
65	2043	Telok Air	1997	4	0	0	0	0 (Collapsed)	0	00-43-48S	109-27-11	10	Pontianak	1
66	2044	Telok Air	1997	4	0	0	0	0 (Collapsed)	0	00-45-12S	109-25-50	10	Pontianak	1
67	2045	Telok Air	1997	4	0	0	0	0 (Collapsed)	0	00-44-00S	109-32-55	10	Pontianak	1
68	2068	Telok Air	1983	18	0	0	0	0 (Collapsed)	0	00-00-16N	109-18-04	10	Pontianak	1
69	2075	Wajok hulu	1986	15	0	0	0	0 (Collapsed)	0	00-00-55N	109-16-45	10	Pontianak	1
70	2076	Sei Serok	1986	15	1	0	0	0	0	00-00-10N	109-17-36	10	Pontianak	2
71	2080	Lemanbudi	1986	15	0	0	0	0 (Collapsed)	0	01-16-20S	108-52-25	10	Pontianak	1
72	2091	Sambas Belakang	1993	8	0	0	0	0 (Collapsed)	0	01-11-29N	108-59-02	10	Pontianak	1

Appendix 2.1.1.

Rehabilitation and Improvement of Visual Aids to Navigation in Short Term Plan (Light Beacon)

No.	DSI No.	Location	Construction Year	Age	Operation Status	Lantern Condition	Power Supply Condition	Structure Condition	DUP	Latitude	Longitude	Structure Height (GL:m)	DISNAV	Phase
73	2132	Pemangkat	1977	24	0	0	0	0 (Collapsed)	0	01-11-52N	108-55-10	10	Pontianak	1
76	2138	Kerbau Ketapang	1985	16	1	1	1	0	0	01-45-31S	109-56-07	10	Pontianak	2
77	2139	Kerbau Ketapang	1989	12	0	0	0	0 (Collapsed)	0	01-45-24S	109-56-03	10	Pontianak	1
78	2143	Kr. P. Buan	1994	7	0	0	0	0 (Collapsed)	0	01-28-05S	109-03-00	10	Pontianak	1
79	2180	Pel. Serasan	1990	11	0	0	0	0	0	02-29-50N	109-00-43	20	Tg.Pinang	2
80	2201	Kr.Serval	1988	13	0	0	0	0 (Collapsed)	0	03-04-30N	108-02-04	10	Tg.Pinang	1
81	2272	Merak Besar	1976	25	0	0	0	0 (Collapsed)	1	05-56-04S	105-59-31	10	Tg. Priok	1
83	2330	Teluk Betung	1971	30	1	0	0	1	0	05-28-03S	105-18-40	10	Tg. Priok	2
85	2381	Tg. Tua	1981	20	0	0	0	1	0	05-54-22S	105-43-00	20	Tg. Priok	1
86	2420	Gs. Jong	1974	27	0	0	0	0	1	05-51-09S	106-38-44	10	Tg. Priok	1
87	2430	Kroe	1971	30	0	0	0	0	0	05-11-00S	103-56-00	10	Tg. Priok	1
88	2477	Malakoni	1993	8	0	0	0	0 (Collapsed)	0	05-20-26S	102-17-19	10	Tg. Priok	1
89	2600	Bukit Tampak	1979	22	1	1	1	0	0	01-00-23S	100-22-52	10	Tlk. Bayur	2
90	2671	Ujung Tiku	1982	19	1	0	0	0	0	00-25-28S	099-53-32	20	Tlk. Bayur	2
91	2672	Kr. Ingaris	1990	11	1	0	0	0	0	00-29-10S	099-51-30	10	Tlk. Bayur	2
92	2673	Gs. Moller	1990	11	0	0	0	0	1	00-04-20S	099-24-00	10	Tlk. Bayur	1
93	2691	Uj.Marit	1990	11	0	0	0	0	0	00-00-56N	098-15-40	20	Sibolga	1
94	2713	Natal	1983	18	1	1	1	0	0	00-33-00N	099-06-12	10	Sibolga	2
95	2713.1	P. Unggas	1996	5	1	1	1	0	0	00-36-34N	099-03-10	10	Sibolga	2
96	2714	P.Sidakah	1984	17	0	0	0	0	1	00-51-34N	098-56-18	20	Sibolga	1
97	2730	Ujung Silabi	1987	14	1	1	1	0	0	02-01-41N	098-15-35	10	Sibolga	2
98	2735	P. Bintana	1993	8	0	0	0	0	0	01-28-35N	098-10-20	20	Sibolga	1
99	2760	P. Baleh	1984	17	1	0	0	0	0	02-17-36N	097-24-12	10	Sibolga	1
100	2761	Kr. Panjang	1976	25	1	0	0	0	0	02-16-46N	097-23-23	10	Sibolga	2
101	2770	Batu Makele	1979	22	1	1	1	0	0	00-03-18S	098-17-29	10	Sibolga	2
102	2780	Batu Makele	1979	22	1	1	1	0	0	00-03-40S	098-17-36	18	Sibolga	2
103	2791	Gs.Ular	1984	17	1	1	1	0	0	00-05-10N	098-56-55	10	Sibolga	2
104	2800	P.Tello	1979	22	1	1	1	0	0	00-03-08S	098-16-48	20	Sibolga	2
105	2820	P.Hinako	1981	20	1	1	1	0	0	00-52-38N	097-20-36	20	Sibolga	2
106	2831	Gn.Sitoli	1984	17	1	1	1	0	0	01-18-12N	097-36-12	20	Sibolga	2

Appendix 2.1.1.

Rehabilitation and Improvement of Visual Aids to Navigation in Short Term Plan (Light Beacon)

No.	DSI No.	Location	Construction Year	Age	Operation Status	Lantern Condition	Power Supply Condition	Structure Condition	DUP	Latitude	Longitude	Structure Height (GL:m)	DISNAV	Phase
108	2840	Sikabaluan	*		0	0	0	0 (Collapsed)	1	01-07-18N	098-59-42	10	Tlk. Bayur	1
109	2850	Gs.Baohi Lahewa	1981	20	0	0	0	0	1	01-26-05N	097-10-10	10	Sibolga	1
110	2855	P. Sumbawga	1992	9	0	0	0	0	0	00-54-26N	098-00-48	30	Sibolga	1
111	2870	Tg.Hele	1974	27	0	0	0	0	1	00-32-40N	097-49-17	10	Sibolga	1
112	2881	Krueng Rangsa Sinabang	1976	25	1	1	1	0	0	02-31-44N	096-23-56	10	Sabang	2
113	2960	P. Rusa	1978	23	1	0	0	0	0	05-16-40N	095-12-00	10	Sabang	1
114	3062	Tg. Sengarong	1980		0	0	0	0	0	06-45-20S	108-49-10	10	Tg. Priok	1
115	3080	Tegal	1982	19	1	1	1	0	0	06-50-40S	109-08-06	20	Semarang	2
116	3090	Trgal	1979	22	1	1	1	0	0	06-50-43S	109-08-08	20	Semarang	2
117	3100	Tegal	1979	22	1	1	1	0	0	06-50-51S	109-08-10	10	Semarang	2
118	3160	Pekolomgan	1984	17	1	1	1	0	0	06-51-26S	109-41-30	10	Semarang	2
121	3273	Alur Ma. Pel. Juana	1991	10	0	0	0	0 (Collapsed)	1	06-39-00S	111-10-00	10	Semarang	1
122	3275	Juwana	1990	11	0	0	0	0	1	06-39-05S	111-10-30	10	Semarang	1
123	3276	Juana	1990	11	0	0	0	0	1	06-40-15S	111-10-30	10	Semarang	1
124	3277	Alur Ma. Pel. Juana	1991	10	0	0	0	0 (Collapsed)	0	06-40-18S	111-10-42	10	Semarang	1
126	3293	Tg. Pudak	1986	15	0	0	0	0	0	05-53-21S	110-26-52	20	Semarang	1
127	3608	Keramaian	1984	17	1	1	1	0	1	05-02-30S	114-37-00	20	Surabaya	2
129	4070	Tg. Pasir	1971	30	1	1	1	0	0	08-05-50S	114-26-05	10	Benoa	2
130	4122	Kr. Wuni Wates	1991	10	0	0	0	0	1	07-55-42S	110-06-16	30	Cilacap	1
131	4125	Tg. Sodong NK	1981	20	1	1	1	0	0	07-44-33S	108-59-21	20	Cilacap	2
132	4167	Tg. Sari	1976	25	0	0	0	0	1	08-31-43S	115-30-17	20	Benoa	1
133	4185	Keramat Lebar	1986	15	1	1	1	0	0	08-44-22S	116-03-40	10	Benoa	2
134	4190	Gendang	1992	9	0	0	0	0	0	08-45-06S	115-49-12	10	Benoa	1
135	4200	Petagan	1981	20	1	1	1	0	1	08-26-05S	116-45-17	20	Benoa	1
136	4201	Sekunci	1984	17	0	0	0	0	1	07-51-30S	117-12-30	20	Benoa	1
137	4220	Tg. Mankun	1994	7	0	0	0	0	1	09-00-38S	116-43-52	30	Benoa	1
138	4310	Waingapu	1981	20	1	1	1	0	0	09-38-02S	120-15-25	10	Kupang	2
139	4331	Lawandau Kotawar	1987	14	0	0	0	0	0	02-55-25S	111-23-00	10	Banjarmasin	1
140	4336	Tg. Keluang	1990	11	1	0	0	0	0	02-54-15S	111-42-11	10	Banjarmasin	1
141	4337	Tg. Serambut	1987	14	1	0	0	0 (Collapsed)	1	02-59-11S	113-03-12	17	Banjarmasin	1

Appendix 2.1.1.

Rehabilitation and Improvement of Visual Aids to Navigation in Short Term Plan (Light Beacon)

No.	DSI No.	Location	Construction Year	Age	Operation Status	Lantern Condition	Power Supply Condition	Structure Condition	DUP	Latitude	Longitude	Structure Height (GL:m)	DISNAV	Phase
142	4338	Tg. Serambut	1986	15	0	0	0	0 (Collapsed)	1	02-59-24S	113-03-12	10	Banjarmasin	1
143	4468	Gosong Keramat	1993	8	0	0	0	1	0	03-32-06S	116-00-20	10	Banjarmasin	1
144	4630	Karang Suling	1990	11	1	1	1	0	0	02-22-30S	116-43-31	10	Samarinda	2
145	4640	Aru Bank	1990	11	1	1	1	0	0	02-15-31S	116-40-00	10	Samarinda	2
146	4641	Telk Apar	1985	16	0	0	0	0	0	02-02-42S	116-33-00	20	Samarinda	1
147	4645	Teluk Adang	1983	18	0	0	0	0	0	01-45-00S	116-28-20	10	Samarinda	1
148	4658	P. Seturian	1991	10	0	0	0	0	0	02-16-20S	117-39-40	10	Samarinda	1
149	4731	Balikpapan	1990	11	0	0	0	0	0	01-13-32S	116-48-20	10	Samarinda	1
150	4748	Tg. Nibung	1982	19	0	0	0	0 (Collapsed)	0	00-48-30S	117-17-51	10	Samarinda	1
151	4749	Tg. Nibung	1982	19	0	0	0	0	0	00-48-06S	117-17-45	20	Samarinda	1
152	4762	S. Marian	1984	17	1	1	1	0	0	00-34-54S	117-16-36	10	Samarinda	2
153	4763	Kutai River	1990	11	0	0	0	0 (Collapsed)	0	00-34-20S	117-16-20	10	Samarinda	1
154	4768	Mahakam River	1990	11	0	0	0	0 (Collapsed)	0	00-20-15S	117-29-42	10	Samarinda	1
155	4911	Sibald Bank	1994	7	0	0	0	0 (Collapsed)	1	05-46-00S	117-07-00	20	Makassar	1
159	5012	Batu Nombongan	1985	16	0	0	0	0 (Collapsed)	0	04-52-45S	119-22-00	10	Makassar	1
164	5160	Kr.Malalungun	1985	16	1	1	1	0	1	01-55-32N	118-26-40	10	Tarakan	1
165	5164	Muara pantai	1990	11	1	1	1	0	0	02-01-50N	117-51-18	10	Tarakan	2
167	5176	Tg.Ulingan	1992	9	0	0	0	0	1	02-12-08N	118-02-40	10	Tarakan	1
169	5312	Tg.Harapan	1991	10	1	1	1	0	1	04-03-30N	117-45-05	10	Tarakan	1
172	5351	Pel.Inobonto	*		0	0	0	0 (Collapsed)	0	00-55-30N	124-06-00	20	Manado/Bitun	1
173	5410	Pel.Tagulandang	*		0	0	0	0 (Collapsed)	0	02-20-30N	125-23-00	20	Manado/Bitun	1
174	5440	Pel.Peta	*		0	0	0	0 (Collapsed)	0	03-39-30N	125-32-30	10	Manado/Bitun	1
176	5468	Pel.Belang	*		0	0	0	0 (Collapsed)	0	00-56-00N	124-47-00	20	Manado/Bitun	1
177	5469	Pel.Kotabunan	*		0	0	0	0 (Collapsed)	0	00-47-50N	124-38-31	20	Manado/Bitun	1
178	5492	Pel.Tilamuta	*		0	0	0	0 (Collapsed)	0	00-30-00N	122-20-11	20	Manado/Bitun	1
179	5495	Pel.Moutong	*		0	0	0	0 (Collapsed)	0	00-27-20N	121-13-30	20	Manado/Bitun	1
182	5540	Pel.Una-Una	*		0	0	0	0 (Collapsed)	0	00-08-00S	121-39-00	20	Manado/Bitun	1
183	5549	Alur masuk Pel.Lu	1994	7	1	1	1	0	0	00-57-03S	122-47-34	10	Manado/Bitun	2
186	5557	Kg.Bekakang	1995	6	1	1	1	0	0	01-35-06S	123-27-30	10	Manado/Bitun	2
190	5578	Bunk toko	1977	24	0	0	0	0 (Collapsed)	0	03-58-24S	122-36-23	10	Kendari	1

Appendix 2.1.1.

Rehabilitation and Improvement of Visual Aids to Navigation in Short Term Plan (Light Beacon)

No.	DSI No.	Location	Construction Year	Age	Operation Status	Lantern Condition	Power Supply Condition	Structure Condition	DUP	Latitude	Longitude	Structure Height (GL:m)	DISNAV	Phase
194	5583	Twelling Barat	1992	9	0	0	0	0 (Collapsed)	0	04-12-54S	122-55-00	10	Kendari	1
197	5614	P.Siompu	1985	16	0	0	0	0 (Collapsed)	1	05-41-30S	122-27-40	20	Kendari	1
198	5673	Padamarang	1978	23	1	0	0	0	0	04-03-20S	121-22-48	10	Kendari	1
204	5851	Waitidal	1981	20	0	0	0	0 (Collapsed)	0	07-07-25S	131-43-14	20	Ambon	1
206	5882	Pel. Tual	1976	25	1	0	0	1	0	05-38-27S	132-44-12	30	Ambon	2
208	5886	Pel. Tual	1978	23	0	0	0	0	0	05-34-10S	132-40-16	20	Ambon	1
209	5915	Kr.Dododahohe	1988	13	0	0	0	0 (Collapsed)	1	01-59-05S	128-12-36	10	Ambon	1
210	5959	Batu Sarip	1982	19	1	1	1	0	0	04-30-11S	129-53-03	10	Ambon	2
211	5974	Daruba	*		0	0	0	1	0	02-35-55N	128-17-05	10	Ambon	1
212	5980	Hatilang	1978	23	0	0	0	0	0	02-47-20S	129-29-30	10	Ambon	1
213	6005	Tg. Yatung	1981	20	0	0	0	0	0	08-26-53S	140-18-26	20	Merauke	1
214	6008	Merauke	1992	9	0	0	0	0 (Collapsed)	0	08-28-36S	140-21-07	20	Merauke	1
215	6020	Ujung Digul	1991	10	0	0	0	0	1	06-55-58S	138-31-47	10	Merauke	1
216	6046	Ma.Keakwa	1985	16	0	0	0	0	1	04-45-21S	136-30-31	30	Sorong	1
217	6060	Pel.Fakfak	1989	12	0	0	0	0 (Collapsed)	0	02-56-16S	132-17-40	10	Sorong	1
218	6160	Kr.Membok	1980	21	0	0	0	0	1	01-24-25S	130-54-40	10	Sorong	1
220	6200	Saokorem	1984	17	0	0	0	0	0	00-33-05S	133-09-00	30	Sorong	1
224	6280	Balbili	1948	53	0	0	0	0	1	01-05-30S	131-11-00	10	Sorong	1
227	6390	Batanta	1948	53	1	0	0	1	0	00-54-36S	130-36-30	10	Sorong	2
230	132005	Rambu suar	1994	7	0	0	0	0 (Collapsed)	0	00-51-00N	107-37-06	10	Pontianak	1
231	132006	Rambu suar	1994	7	0	0	0	0 (Collapsed)	0	00-45-03N	107-19-200	10	Pontianak	1

Appendix 2.1.2.
Development of Visual Aids to Navigation in Short Term Plan (Lighthouse)

No.	DISNAV	Location	Latitude	Longitude	Structure Height (GL:)	Site	Total Score	Priority	Phase
5	Tg.Pinang	P. Panjang	04-15-23N	108-12-37E	10	On Land	51.00	2	1
7	Tg.Pinang	P.Timau	03-17-19N	107-33-14E	10	On Land	43.50	3	1
9	Tg.Pinang	Tg. Kemantan	00-59-39N	107-35-59E	40	On Land	37.00	12	2
10	Tg.Pinang	Tg. Sading	01-11-48N	104-23-40E	40	On Land	57.50	1	1
13	Palembang	Ayermasin	03-15-00S	108-23-00E	40	On Land	38.50	8	2
14	Palembang	P. Cebia	01-12-21S	105-16-02E	40	On Land	37.50	12	1
15	Palembang	Tg. Lesum	01-38-55S	105-20-54E	40	On Land	32.50	22	1
17	Palembang	Uj. Batakarang	02-00-42S	104-50-16E	40	On Land	37.50	12	1
23	Tg. Priok	Uj. Genteng	07-22-49S	106-24-15E	40	On Land	38.50	8	2
26	Surabaya	Memburit	06-50-02S	115-13-00E	40	On Land	41.00	4	1
28	Benoa	P. Menjangan	08-05-38S	114-31-36E	40	On Land	41.50	4	1
32	Benoa	Tg. Tekurenan	08-10-45S	115-28-46E	40	On Land	32.50	22	2
39	Samarinda	Tg.Aru	02-11-00S	116-34-59E	40	On Land	38.50	8	2
50	Kendari	P.Anano	05-18-00S	124-17-59E	40	On Land	35.00	17	2
56	Kupang	Seraja Besar	08-22-19S	119-51-20E	40	On Land	41.00	4	2
59	Kupang	Tg. Muna	08-11-00S	124-18-30E	40	On Land	33.00	19	2
75	Ambon	Tg. Weduar	06-00-30S	132-50-30E	40	On Land	36.00	15	2
78	Ambon	Walwat tinggi	03-37-20S	126-11-41E	40	On Land	33.50	19	2

Appendix 2.1.3.
Development of Visual Aids to Navigation in Short Term Plan (Light Beacon)

No.	DISNAV	Location	Latitude	Longitude	Structure Height (GL:)	Site	Total Score	Priority	Phase
17	Sibolga	Kr.Karang	00-42-45N	098-56-15E	10	On Land	30	53	2
19	Sibolga	Kr.Lago	00-01-27N	098-27-18E	20	On Land	31	47	2
20	Sibolga	Kr.Tonga	00-01-59N	098-44-30E	10	Offshore	31	47	2
22	Sibolga	P.Sarudut	01-43-41N	098-46-36E	20	On Land	32	44	2
24	Sibolga	Pel.Sibolga	01-44-38N	096-46-02E	20	On Land	30	53	2
34	Dumai	Gs.Mumbul	02-03-17N	101-25-38E	10	Offshore	42.5	12	1
35	Dumai	Pel.Kuala Enok	00-31-59S	103-26-38E	10	Offshore	37.5	23	1
36	Dumai	Pel.Kuala Enok	03-32-51S	103-27-42E	10	Offshore	37.5	23	1
37	Dumai	Pel.Kuala Enok	00-34-57S	103-29-10E	10	Offshore	37.5	23	1
38	Dumai	Selatan P.Tengah	01-07-20N	102-09-34E	10	Offshore	38	20	1
39	Dumai	Tg.Layang	01-13-22N	102-10-29E	10	Offshore	38	20	1
40	Dumai	Utara P.Tengah	01-08-13N	102-09-35E	10	Offshore	38	20	1
41	Tg.Pinang	P. Ritan	02-35-47N	106-16-29E	10	On Land	45	9	1
45	Tg.Pinang	Kr.Nginang	00-58-50N	104-09-31E	10	Offshore	45	9	1
47	Tg.Pinang	Lap.1980	01-43-59N	107-24-30E	10	Offshore	30	53	2
48	Tg.Pinang	P. Batuberlayar	00-24-08N	104-14-53E	10	On Land	35	31	1
55	Tg.Pinang	P.Selanga	00-29-15N	104-21-23E	20	On Land	35	31	1
52	Tg.Pinang	Pel.Midai	02-59-44N	107-44-39E	10	Offshore	46	4	1
53	Tg.Pinang	Pel.Midai	03-00-00N	107-44-38E	10	Offshore	46	4	1
54	Tg.Pinang	Pel.Midai	02-59-57N	107-44-52E	20	On Land	46	4	1
58	Tg.Pinang	P. Senggakang	00-55-43N	104-25-31E	10	Offshore	47.5	2	1
59	Tg.Pinang	P. Penyengat	00-55-16N	104-25-05E	10	Offshore	47.5	2	1
62	Tlk. Bayur	Kr. Pincuran Butun	00-11-39N	099-21-54E	10	Offshore	31.5	46	2
65	Tlk. Bayur	P. Laut	01-08-14S	100-10-00E	10	On Land	30.5	50	2
67	Palembang	Kr. Haji	02-05-33S	105-06-23E	10	Offshore	42.5	12	1
68	Palembang	Ma. Kuala Tungkal	00-47-40S	103-30-40E	10	Offshore	37.5	23	1
69	Palembang	Ma. Kuala Tungkal	00-46-01S	103-32-00E	10	Offshore	37.5	23	1
74	Palembang	Selat Nando	02-55-14S	107-26-49E	10	Offshore	35.5	23	1
75	Palembang	Tg. Terentang	01-34-58S	105-43-13E	10	Offshore	37.5	23	1
78	Tg. Priok	Bayangan Air	05-44-54S	105-58-59E	10	Offshore	35	31	2
79	Tg. Priok	Gs. Tohorjantan	05-47-25S	106-47-51E	10	On Land	37.5	23	2
80	Tg. Priok	Kr. Gundul	05-51-20S	106-34-12E	10	Offshore	35	31	1
81	Tg. Priok	Kr. Kerbau	05-46-11S	106-26-29E	10	Offshore	45	9	1
87	Tg. Priok	Tg.Karawang	05-55-55S	106-58-48E	10	Offshore	40	16	1
88	Semarang	Alur Pel. Karimun Jawa	05-53-27S	110-26-18E	10	Offshore	35	31	1

Appendix 2.1.3.
Development of Visual Aids to Navigation in Short Term Plan
(Light Beacon)

No.	DISNAV	Location	Latitude	Longitude	Structure Height (GL·)	Site	Total Score	Priority	Phase
89	Semarang	Alur Pel. Karimun Jawa	05-53-10S	110-26-18E	10	Offshore	35	31	1
90	Semarang	Alur Pel. Karimun Jawa	05-53-08S	110-26-55E	10	Offshore	35	31	1
100	Surabaya	GS. Castor	07-19-00S	112-53-00E	10	Offshore	52.5	1	1
101	Surabaya	P. Gililawak	07-12-24S	114-02-41E	20	On Land	32	44	2
102	Surabaya	P. Giliyang	06-58-35S	114-11-15E	20	On Land	32.5	41	2
103	Surabaya	P. Kambing	07-18-29S	113-13-15E	10	Offshore	30	53	2
104	Surabaya	P.Sepekan	07-00-57S	115-42-44E	20	On Land	42.5	12	1
116	Banjarmasin	Ma. S. Barito	03-32-38S	114-29-42E	10	Offshore	30.5	50	2
117	Banjarmasin	Ma. S. Barito	03-32-25S	114-29-51E	10	Offshore	30.5	50	2
130	Samarinda	Kr.Unarang	02-25-48S	117-02-30E	10	Offshore	32.5	41	2
131	Samarinda	Muara Berau	00-32-30S	117-24-49E	10	Offshore	39	19	2
143	Manado/Bitung	Napu Arampua	04-38-17N	127-04-47E	10	Offshore	43.5	12	1
149	Manado/Bitung	P.Sanggeluhang	02-57-20N	125-28-20E	10	Offshore	30	53	2
156	Manado/Bitung	Awit	04-19-30N	126-41-14E	20	On Land	46	4	1
159	Manado/Bitung	Pel.Tamako	03-26-49N	125-29-33E	20	On Land	46	4	1
161	Manado/Bitung	Sanggelukang	02-57-29N	125-27-00E	10	On Land	30	53	2
168	Manado/Bitung	Tg. Papalanpungan	03-58-52N	126-44-38E	30	On Land	40	16	1
181	Kendari	Kr. Lingoro	03-58-59S	122-48-51E	10	Offshore	35	31	2
190	Kendari	Kr. Selat Masiri	05-39-20S	121-37-00E	10	Offshore	35	31	2
199	Kendari	Kr. Utara Kaledupa	05-36-20S	123-31-30E	10	Offshore	30	53	2
200	Kendari	Kr. Utara Kapota	05-27-34S	123-22-10E	10	Offshore	30	53	2
208	Kendari	P. Togomongolo	03-13-17S	122-38-20E	10	On Land	35	40	2
217	Makassar	Jampea	07-49-00S	120-25-46E	10	Offshore	32.5	41	2
224	Makassar	Kr.P.Saujung	07-32-30S	117-31-00E	10	Offshore	40	16	2
231	Makassar	P. Marasende	05-07-30S	118-09-00E	20	On Land	31	47	2
240	Makassar	Tg. Appatana	06-30-00S	120-29-30E	10	Offshore	30	53	2

Appendix 3.1.1

Rehabilitation and Improvement of Visual Aids to Navigation in Short Term Plan (Lighthouse)

NO.	DSI No.	Location	Construction (Rehab.) Year	Age	Operation Status	Lantern Condition	Power Supply condition	Structure Condition	DUP	Latitude	Longitude	Structure Height (m)	DISNAV	Phase
1	10	Ie. Meule	1974	27	1	0	0	0	0	05-53-48N	095-19-48E	3	Sabang	1
2	11	Rondo	1984	17	1	0	0	0	1	06-04-02N	095-06-50E	*	Sabang	1
3	77	P. Bunta	1980	21	1	0	0	0	1	05-33-11N	095-09-05E	50	Sabang	1
4	84	Ujung Pidie	1987	14	0	0	0	0	1	05-30-00N	095-52-60E	20	Sabang	1
5	960	P.Berhala	1978	23	1	0	0	0	0	00-52-26S	104-24-30E	21	Tg.Pinang	1
6	1000	Tunjuk I	1975	26	1	1	1	0	1	00-56-41N	104-12-10E	16	Tg.Pinang	1
7	1110	Tunjuk II	1975	26	1	1	1	0	1	01-13-02N	104-34-30E	*	Tg.Pinang	1
9	2025	P. Pengiki	1982	19	1	1	1	0	1	00-14-11N	108-02-25E	15	Pontianak	1
10	2223	Tg.Sekatung	1984	17	1	0	0	0	0	04-47-31N	108-01-14E	30	Tg.Pinang	1
13	2931	Ujung Raja	1988	13	0	0	0	0	1	03-44-15N	096-31-10E	40	Sabang	1
14	3070	Tegal I	1983	18	0	0	0	0(co)	1	06-51-07S	109-08-13E	13	Semarang	1
15	3130	Tegal II	1982	19	1	0	0	0	1	06-50-49S	109-08-17E	30	Semarang	1
16	3271	P. Panjang	1989	12	1	0	0	0	1	06-34-18S	110-37-26E	40	Semarang	1
17	3290	P. Mandalika	1886	115	1	0	0	0	1	06-22-22S	110-55-30E	16	Semarang	1
18	3300	P. Nyamuk	1980	21	1	0	0	0	1	05-48-41S	110-11-20E	30	Semarang	1
19	4150	Buleleng	1978	23	1	0	0	1	0	08-05-2S	115-05-30E	20	Benoa	1
20	4170	Lembongan	1974	27	1	1	1	0	0	08-39-39S	115-27-30E	25	Benoa	1
22	4311	Tg. Sasar	1988	13	0	0	0	0(co)	1	09-16-13S	119-56-30E	40	Kupang	1
23	4730	Tukong Hill	1980	21	1	1	1	0	1	01-16-08S	116-48-30E	8	Samarinda	1
24	4950	Tg.Bunga	1980	21	1	0	0	0	1	05-09-00S	119-24-00E	40	Makassar	1
34	6205	P.Adi	1981	20	0	0	0	0(co)	0	04-18-15S	133-37-10E	20	Sorong	1

Appendix 3.1.2.

Rehabilitation and Improvement of Visual Aids to Navigation in Priority Project (Light Beacon)

No.	DSI No.	Location	Construction Year	Age	Operation Status	Lantern Condition	Power Supply Condition	Structure Condition	DUP	Latitude	Longitude	Structure Height (m)	On/ Offshore	DISNAV	Phase
1	150	Kuala Langsa	1980	21	0	0	0	0	1	04-32-41N	098-03-02	12	Offshore	Belawan	1
2	160	Kuala Langsa	1980	21	0	0	0	0	1	04-33-08N	098-03-36	8	Offshore	Belawan	1
3	180	Kuala Langsa	1980	21	0	0	0	0	1	04-33-33N	098-04-22	10	ON	Belawan	1
4	190	Kuala Langsa	1980	21	0	0	0	0	1	04-33-01N	098-03-56	18	ON	Belawan	1
5	390	Belawan Deli	1983	18	0	0	0	0	1	03-48-54N	098-43-00	5.5	Offshore	Belawan	1
6	400	Belawan Deli	1983	18	0	0	0	0 (Collapsed)	1	03-48-06N	098-43-15	5.5	Offshore	Belawan	1
7	410	Belawan Deli	1983	18	1	0	0	1	1	03-47-22N	098-43-38	12	Offshore	Belawan	1
8	450	Sungai Nunang	1979	22	0	0	0	0 (Collapsed)	0	03-47-18N	098-40-46	10	Offshore	Belawan	1
9	451	Sungai Nunang	1984	17	0	0	0	0 (Collapsed)	0	03-47-30N	098-40-42	10	Offshore	Belawan	1
10	510	Tg.Tiram	1984	17	1	0	0	1	1	03-14-54N	099-35-19	10	Offshore	Belawan	1
11	550	Bagan Asahan	1977	24	1	0	0	1	1	03-02-46N	099-51-56	15	Offshore	Belawan	1
12	551	S.Asahan Depan	1993	8	0	0	0	0 (Collapsed)	0	03-01-44N	099-51-40	10	Offshore	Belawan	1
14	650	Tg.Leban	1991	10	0	0	0	0	1	01-39-30N	101-50-30	10	ON	Dumai	1
17	677	Selat Rupat E	1991	10	0	0	0	0	1	01-41-23N	101-48-09	20	ON	Dumai	1
18	679	Selat Rupat G	1991	10	0	0	0	0	1	01-41-30N	101-47-53	20	Offshore	Dumai	1
20	740	Sei Siak	1984	17	0	0	0	0 (Collapsed)	0	01-12-30N	102-10-00	10	Offshore	Dumai	1
21	750	Sei Siak	1961	40	0	0	0	0	0	01-11-30N	102-09-30	10	Offshore	Dumai	1
25	928	Tg.Bakau	1978	23	0	0	0	1	1	00-20-00S	103-47-30	10	Offshore	Dumai	1
30	1088	P.Kambat	1989	12	0	0	0	0 (Collapsed)	1	00-48-30N	104-39-54	10	Offshore	Tg.Pinang	1
31	1112	Kr.Heluputan	1992	9	0	0	0	0 (Collapsed)	0	00-37-15N	105-08-30	10	Offshore	Tg.Pinang	1
34	1180	Pelab. Dabo	1990	11	0	0	0	0 (Collapsed)	0	00-29-30S	104-33-30	10	ON	Tg.Pinang	1
35	1190	P.Saya	1994	7	0	0	0	0 (Collapsed)	0	00-46-50S	104-55-58	20		Tg.Pinang	1
36	1270	Hendrik	1982	19	0	0	0	0	0	01-58-00S	104-57-10	20	ON	Palembang	1
37	1271	Tg. Kampeh	1980	21	0	0	0	0 (Collapsed)	0	02-11-27S	104-54-04	20	ON	Palembang	1
38	1300	Bak I	1996	5	1	0	0	0	1	02-13-11S	104-55-34	10	Offshore	Palembang	1
39	1310	Bak II	1981	20	0	0	0	0 (Collapsed)	1	02-12-50S	104-55-42	20	Offshore	Palembang	1
41	1682	Maspari	1986	15	0	0	0	0 (Collapsed)	0	03-13-08S	106-13-00	40	ON	Tg. Priok	1
42	1684	Tg. Menjangan	1995	6	0	0	0	1	0	03-49-14S	106-00-03	10	ON	Tg. Priok	1
43	1687	Tg. Bungin	1999	2	0	0	0	1	0	04-33-28S	106-03-29	10	ON	Tg. Priok	1
44	1689	Gs. Serdang	1994	7	0	0	0	1	0	05-04-30S	106-16-36	10	ON	Tg. Priok	1
46	1708	Tg. Priok	1993	8	0	0	0	0 (Collapsed)	0	06-05-41S	106-52-40	10	ON	Tg. Priok	1
47	1710	Beting Eka	1792	9	0	0	0	0 (Collapsed)	1	05-17-32S	106-54-30	10	Offshore	Tg. Priok	1
48	1740	Tg. Kerawang	1979	22	0	0	0	0 (Collapsed)	1	05-54-18S	107-00-28	10	Offshore	Tg. Priok	1
49	1751	P. Putri	1983	18	0	0	0	0	0	06-04-07S	106-51-18	10	ON	Tg. Priok	1
50	1752	Kr. Lamteri	1983	18	0	0	0	0	0	06-04-25S	106-49-50	10	ON	Tg. Priok	1

Appendix 3.1.2.

Rehabilitation and Improvement of Visual Aids to Navigation in Priority Project (Light Beacon)

No.	DSI No.	Location	Construction Year	Age	Operation Status	Lantern Condition	Power Supply Condition	Structure Condition	DUP	Latitude	Longitude	Structure Height (m)	On/ Offshore	DISNAV	Phase
51	1820	Pel. Pertamina	1982	19	0	0	0	0	0	06-05-49S	105-53-41	10	ON	Tg. Priok	1
52	1821	Pel. Pertamina	1982	19	0	0	0	0 (Collapsed)	0	06-05-38S	106-54-18	10	ON	Tg. Priok	1
53	1822	Pel. Pertamina	1982	19	0	0	0	0 (Collapsed)	0	06-05-51S	106-54-14	10	ON	Tg. Priok	1
54	1823	Pel. Pertamina	1985	16	0	0	0	0 (Collapsed)	0	06-05-40S	106-53-41	10	ON	Tg. Priok	1
55	1831	Kr. Belikat	1995	6	0	0	0	1	0	02-28-00S	106-58-20	20	ON	Palembang	1
56	1910	Tg. Pandang	1973	28	0	0	0	0 (Collapsed)	0	02-44-10S	107-35-42	10	Offshore	Tg. Priok	1
57	1911	Kr. Tanjung Pandan	1993	8	0	0	0	0 (Collapsed)	0	02-43-58S	107-35-30	10	Offshore	Palembang	1
58	1916	Magdalena	1994	7	0	0	0	0 (Collapsed)	0	02-01-18S	106-32-24	10	ON	Palembang	1
59	1950	Pangkal baran depan	1979	22	0	0	0	0	0	02-05-40S	106-09-57	20	Offshore	Palembang	1
60	1970	Fox Bank	1989	12	1	0	0	1	1	03-30-40S	110-11-00	10	Offshore	Tg. Priok	1
61	2010	Kanis	1973	28	0	0	0	0 (Collapsed)	0	02-37-18S	108-12-20	10	ON	Tg. Priok	1
63	2041	Telok Air	1995	6	0	0	0	0 (Collapsed)	0	00-40-54S	109-22-10	10	ON	Pontianak	1
64	2042	Telok Air	1997	4	0	0	0	0 (Collapsed)	0	00-12-32S	109-23-50	10	ON	Pontianak	1
65	2043	Telok Air	1997	4	0	0	0	0 (Collapsed)	0	00-43-48S	109-27-11	10	ON	Pontianak	1
66	2044	Telok Air	1997	4	0	0	0	0 (Collapsed)	0	00-45-12S	109-25-50	10	ON	Pontianak	1
67	2045	Telok Air	1997	4	0	0	0	0 (Collapsed)	0	00-44-00S	109-32-55	10	ON	Pontianak	1
68	2068	Telok Air	1983	18	0	0	0	0 (Collapsed)	0	00-00-16N	109-18-04	10	ON	Pontianak	1
69	2075	Waiok hulu	1986	15	0	0	0	0 (Collapsed)	0	00-00-55N	109-16-45	10	ON	Pontianak	1
71	2080	Lemanbudi	1986	15	0	0	0	0 (Collapsed)	0	01-16-20S	108-52-25	10	ON	Pontianak	1
72	2091	Sambas Belakang	1993	8	0	0	0	0 (Collapsed)	0	01-11-29N	108-59-02	10		Pontianak	1
73	2132	Pemangkat	1977	24	0	0	0	0 (Collapsed)	0	01-11-52N	108-55-10	10	ON	Pontianak	1
77	2139	Kerbau Ketapang	1989	12	0	0	0	0 (Collapsed)	0	01-45-24S	109-56-03	10		Pontianak	1
78	2143	Kr. P. Buan	1994	7	0	0	0	0 (Collapsed)	0	01-28-05S	109-03-00	10	ON	Pontianak	1
80	2201	Kr.Serval	1988	13	0	0	0	0 (Collapsed)	0	03-04-30N	108-02-04	10	Offshore	Tg.Pinang	1
81	2272	Merak Besar	1976	25	0	0	0	0 (Collapsed)	1	05-56-04S	105-59-31	10	Offshore	Tg. Priok	1
85	2381	Tg. Tua	1981	20	0	0	0	1	0	05-54-22S	105-43-00	20	ON	Tg. Priok	1
86	2420	Gs. Jong	1974	27	0	0	0	0	1	05-51-09S	106-38-44	10	Offshore	Tg. Priok	1
87	2430	Kroe	1971	30	0	0	0	0	0	05-11-00S	103-56-00	10	ON	Tg. Priok	1
88	2477	Malakoni	1993	8	0	0	0	0 (Collapsed)	0	05-20-26S	102-17-19	10	ON	Tg. Priok	1
92	2673	Gs. Moller	1990	11	0	0	0	0	1	00-04-20S	099-24-00	10	Offshore	Tlk. Bayur	1
93	2691	Uj.Marit	1990	11	0	0	0	0	0	00-00-56N	098-15-40	20	ON	Sibolga	1
96	2714	P.Sidakah	1984	17	0	0	0	0	1	00-51-34N	098-56-18	20	ON	Sibolga	1
98	2735	P. Bintana	1993	8	0	0	0	0	0	01-28-35N	098-10-20	20	ON	Sibolga	1
99	2760	P. Baleh	1984	17	1	0	0	0	0	02-17-36N	097-24-12	10		Sibolga	1
108	2840	Sikabaluan	*		0	0	0	0 (Collapsed)	1	01-07-18N	098-59-42	10	Offshore	Tlk. Bayur	1

Appendix 3.1.2.

Rehabilitation and Improvement of Visual Aids to Navigation in Priority Proje ct (Light Beacon)

No.	DSI No.	Location	Construction Year	Age	Operation Status	Lantern Condition	Power Supply Condition	Structure Condition	DUP	Latitude	Longitude	Structure Height (m)	On/ Offshore	DISNAV	Phase
109	2850	Gs.Baohi Lahewa	1981	20	0	0	0	0	1	01-26-05N	097-10-10	10	Offshore	Sibolga	1
110	2855	P. Sumbawga	1992	9	0	0	0	0	0	00-54-26N	098-00-48	30	ON	Sibolga	1
111	2870	Tg.Hele	1974	27	0	0	0	0	1	00-32-40N	097-49-17	10	ON	Sibolga	1
113	2960	P. Rusa	1978	23	1	0	0	0	0	05-16-40N	095-12-00	10	ON	Sabang	1
114	3062	Tg. Sengarong	1980	21	0	0	0	0	0	06-45-20S	108-49-10	10	Offshore	Tg. Priok	1
121	3273	Alur Ma. Pel. Juana	1991	10	0	0	0	0 (Collapsed)	1	06-39-00S	111-10-00	10	Offshore	Semarang	1
122	3275	Juwana	1990	11	0	0	0	0	1	06-39-05S	111-10-30	10	ON	Semarang	1
123	3276	Juana	1990	11	0	0	0	0	1	06-40-15S	111-10-30	10	ON	Semarang	1
124	3277	Alur Ma. Pel. Juana	1991	10	0	0	0	0 (Collapsed)	0	06-40-18S	111-10-42	10	Offshore	Semarang	1
126	3293	Tg. Pudak	1986	15	0	0	0	0	0	05-53-21S	110-26-52	20		Semarang	1
130	4122	Kr. Wuni Wates	1991	10	0	0	0	0	1	07-55-42S	110-06-16	30	ON	Cilacap	1
132	4167	Tg. Sari	1976	25	0	0	0	0	1	08-31-43S	115-30-17	20	ON	Benoa	1
134	4190	Gendang	1992	9	0	0	0	0	0	08-45-06S	115-49-12	10	ON	Benoa	1
135	4200	Petagan	1981	20	1	1	1	0	1	08-26-05S	116-45-17	20	Offshore	Benoa	1
136	4201	Sekunci	1984	17	0	0	0	0	1	07-51-30S	117-12-30	20	ON	Benoa	1
137	4220	Tg. Mankun	1994	7	0	0	0	0	1	09-00-38S	116-43-52	30	ON	Benoa	1
139	4331	Lawandau Kotawaringin	1987	14	0	0	0	0	0	02-55-25S	111-23-00	10	ON	Banjarmasin	1
140	4336	Tg. Keluang	1990	11	1	0	0	0	0	02-54-15S	111-42-11	10	ON	Banjarmasin	1
141	4337	Tg. Serambut	1987	14	1	0	0	0 (Collapsed)	1	02-59-11S	113-03-12	17	Offshore	Banjarmasin	1
142	4338	Tg. Serambut	1986	15	0	0	0	0 (Collapsed)	1	02-59-24S	113-03-12	10	Offshore	Banjarmasin	1
143	4468	Gosong Keramat	1993	8	0	0	0	1	0	03-32-06S	116-00-20	10	Offshore	Banjarmasin	1
146	4641	Telk Apar	1985	16	0	0	0	0	0	02-02-42S	116-33-00	20	ON	Samarinda	1
147	4645	Teluk Adang	1983	18	0	0	0	0	0	01-45-00S	116-28-20	10	ON	Samarinda	1
148	4658	P. Seturian	1991	10	0	0	0	0	0	02-16-20S	117-39-40	10	ON	Samarinda	1
149	4731	Balikpapan	1990	11	0	0	0	0	0	01-13-32S	116-48-20	10	ON	Samarinda	1
150	4748	Tg. Nibung	1982	19	0	0	0	0 (Collapsed)	0	00-48-30S	117-17-51	10	ON	Samarinda	1
151	4749	Tg. Nibung	1982	19	0	0	0	0	0	00-48-06S	117-17-45	20	ON	Samarinda	1
153	4763	Kutai River	1990	11	0	0	0	0 (Collapsed)	0	00-34-20S	117-16-20	10		Samarinda	1
154	4768	Mahakam River	1990	11	0	0	0	0 (Collapsed)	0	00-20-15S	117-29-42	10	ON	Samarinda	1
155	4911	Sibald Bank	1994	7	0	0	0	0 (Collapsed)	1	05-46-00S	117-07-00	20	Offshore	Makassar	1
159	5012	Batu Nombongan	1985	16	0	0	0	0 (Collapsed)	0	04-52-45S	119-22-00	10	Offshore	Makassar	1
164	5160	Kr.Malalungun	1985	16	1	1	1	0	1	01-55-32N	118-26-40	10	Offshore	Tarakan	1
167	5176	Tg.Ulingan	1992	9	0	0	0	0	1	02-12-08N	118-02-40	10	Offshore	Tarakan	1
169	5312	Tg.Harapan	1991	10	1	1	1	0	1	04-03-30N	117-45-05	10	Offshore	Tarakan	1
172	5351	Pel.Inobonto	*		0	0	0	0 (Collapsed)	0	00-55-30N	124-06-00	20	ON	Manado/Bitung	1

Appendix 3.1.2.

Rehabilitation and Improvement of Visual Aids to Navigation in Priority Project (Light Beacon)

No.	DSI No.	Location	Construction Year	Age	Operation Status	Lantern Condition	Power Supply Condition	Structure Condition	DUP	Latitude	Longitude	Structure Height (m)	On/ Offshore	DISNAV	Phase
173	5410	Pel.Tagulandang	*		0	0	0	0 (Collapsed)	0	02-20-30N	125-23-00	20	ON	Manado/Bitung	1
174	5440	Pel.Peta	*		0	0	0	0 (Collapsed)	0	03-39-30N	125-32-30	10	ON	Manado/Bitung	1
176	5468	Pel.Belang	*		0	0	0	0 (Collapsed)	0	00-56-00N	124-47-00	20	ON	Manado/Bitung	1
177	5469	Pel.Kotabunan	*		0	0	0	0 (Collapsed)	0	00-47-50N	124-38-31	20	ON	Manado/Bitung	1
178	5492	Pel.Tilamuta	*		0	0	0	0 (Collapsed)	0	00-30-00N	122-20-11	20	ON	Manado/Bitung	1
179	5495	Pel.Moutong	*		0	0	0	0 (Collapsed)	0	00-27-20N	121-13-30	20	ON	Manado/Bitung	1
182	5540	Pel.Una-Una	*		0	0	0	0 (Collapsed)	0	00-08-00S	121-39-00	20	ON	Manado/Bitung	1
190	5578	Bunk toko	1977	24	0	0	0	0 (Collapsed)	0	03-58-24S	122-36-23	10	ON	Kendari	1
194	5583	Twelling Barat	1992	9	0	0	0	0 (Collapsed)	0	04-12-54S	122-55-00	10	Offshore	Kendari	1
197	5614	P.Siompu	1985	16	0	0	0	0 (Collapsed)	1	05-41-30S	122-27-40	20	ON	Kendari	1
198	5673	Padamarang	1978	23	1	0	0	0	0	04-03-20S	121-22-48	10	Offshore	Kendari	1
204	5851	Waitidal	1981	20	0	0	0	0 (Collapsed)	0	07-07-25S	131-43-14	20	ON	Ambon	1
208	5886	Pel. Tual	1978	23	0	0	0	0	0	05-34-10S	132-40-16	20		Ambon	1
209	5915	Kr.Dododahohe	1988	13	0	0	0	0 (Collapsed)	1	01-59-05S	128-12-36	10	Offshore	Ambon	1
211	5974	Daruba	*		0	0	0	1	0	02-35-55N	128-17-05	10	Offshore	Ambon	1
212	5980	Hatilang	1978	23	0	0	0	0	0	02-47-20S	129-29-30	10	Offshore	Ambon	1
213	6005	Tg. Yatung	1981	20	0	0	0	0	0	08-26-53S	140-18-26	20	ON	Merauke	1
214	6008	Merauke	1992	9	0	0	0	0 (Collapsed)	0	08-28-36S	140-21-07	20	ON	Merauke	1
215	6020	Ujung Digul	1991	10	0	0	0	0	1	06-55-58S	138-31-47	10	ON	Merauke	1
216	6046	Ma.Keakwa	1985	16	0	0	0	0	1	04-45-21S	136-30-31	30	ON	Sorong	1
217	6060	Pel.Fakfak	1989	12	0	0	0	0 (Collapsed)	0	02-56-16S	132-17-40	10	ON	Sorong	1
218	6160	Kr.Membok	1980	21	0	0	0	0	1	01-24-25S	130-54-40	10	Offshore	Sorong	1
220	6200	Saokorem	1984	17	0	0	0	0	0	00-33-05S	133-09-00	30		Sorong	1
224	6280	Balbili	1948	53	0	0	0	0	1	01-05-30S	131-11-00	10	Offshore	Sorong	1
230	132005	Rambu suar	1994	7	0	0	0	0 (Collapsed)	0	00-51-00N	107-37-06	10	ON	Pontianak	1
231	132006	Rambu suar	1994	7	0	0	0	0 (Collapsed)	0	00-45-03N	107-19-200	10	ON	Pontianak	1

Appendix 3.1.3.

Development of Visual Aids to Navigation in P riority Project (Lighthouse)

No.	DISNAV	Location	Latitude	Longitude	Structure Height (GL:)	Site	Total Score	Priority	Phase
5	Tg.Pinang	P. Panjang	04-15-23N	108-12-37E	10	On Land	51.000	2	1
7	Tg.Pinang	P.Timau	03-17-19N	107-33-14E	10	On Land	43.500	3	1
10	Tg.Pinang	Tg. Sading	01-11-48N	104-23-40E	40	On Land	57.500	1	1
14	Palembang	P. Cebia	01-12-21S	105-16-02E	40	On Land	37.500	12	1
15	Palembang	Tg. Lesum	01-38-55S	105-20-54E	40	On Land	32.500	22	1
17	Palembang	Uj. Batakarang	02-00-42S	104-50-16E	40	On Land	37.500	12	1
26	Surabaya	Memburit	06-50-02S	115-13-00E	40	On Land	41.000	4	1
28	Benoa	P. Menjangan	08-05-38S	114-31-36E	40	On Land	41.500	4	1

Appendix 3.1.4.

Development of Visual Aids to Navigation in Priority

(Light Beacon)

No.	DISNAV	Location	Latitude	Longitude	Structure Height (GL:m)	Site	Total Score	Priority	Phase
34	Dumai	Gs.Mumbul	02-03-17N	101-25-38E	10	Offshore	42.5	12	1
35	Dumai	Pel.Kuala Enok	00-31-59S	103-26-38E	10	Offshore	37.5	23	1
36	Dumai	Pel.Kuala Enok	03-32-51S	103-27-42E	10	Offshore	37.5	23	1
37	Dumai	Pel.Kuala Enok	00-34-57S	103-29-10E	10	Offshore	37.5	23	1
38	Dumai	Selatan P.Tengah	01-07-20N	102-09-34E	10	Offshore	38	20	1
39	Dumai	Tg.Layang	01-13-22N	102-10-29E	10	Offshore	38	20	1
40	Dumai	Utara P.Tengah	01-08-13N	102-09-35E	10	Offshore	38	20	1
41	Tg.Pinang	P. Ritan	02-35-47N	106-16-29E	10	On Land	45	9	1
45	Tg.Pinang	Kr.Nginang	00-58-50N	104-09-31E	10	Offshore	45	9	1
48	Tg.Pinang	P. Batuberlayar	00-24-08N	104-14-53E	10	On Land	35	31	1
55	Tg.Pinang	P.Selanga	00-29-15N	104-21-23E	20	On Land	35	31	1
52	Tg.Pinang	Pel.Midai	02-59-44N	107-44-39E	10	Offshore	46	4	1
53	Tg.Pinang	Pel.Midai	03-00-00N	107-44-38E	10	Offshore	46	4	1
54	Tg.Pinang	Pel.Midai	02-59-57N	107-44-52E	20	On Land	46	4	1
58	Tg.Pinang	P. Senggakang	00-55-43N	104-25-31E	10	Offshore	47.5	2	1
59	Tg.Pinang	P. Penyengat	00-55-16N	104-25-05E	10	Offshore	47.5	2	1
67	Palembang	Kr. Haji	02-05-33S	105-06-23E	10	Offshore	42.5	12	1
68	Palembang	Ma. Kuala Tungkal	00-47-40S	103-30-40E	10	Offshore	37.5	23	1
69	Palembang	Ma. Kuala Tungkal	00-46-01S	103-32-00E	10	Offshore	37.5	23	1
74	Palembang	Selat Nando	02-55-14S	107-26-49E	10	Offshore	35.5	23	1
75	Palembang	Tg. Terentang	01-34-58S	105-43-13E	10	Offshore	37.5	23	1
80	Tg. Priok	Kr. Gundul	05-51-20S	106-34-12E	10	Offshore	35	31	1
81	Tg. Priok	Kr. Kerbau	05-46-11S	106-26-29E	10	Offshore	45	9	1
87	Tg. Priok	Tg.Karawang	05-55-55S	106-58-48E	10	Offshore	40	16	1
88	Semarang	Alur Pel. Karimun Jawa	05-53-27S	110-26-18E	10	Offshore	35	31	1
89	Semarang	Alur Pel. Karimun Jawa	05-53-10S	110-26-18E	10	Offshore	35	31	1
90	Semarang	Alur Pel. Karimun Jawa	05-53-08S	110-26-55E	10	Offshore	35	31	1
100	Surabaya	GS. Castor	07-19-00S	112-53-00E	10	Offshore	52.5	1	1
104	Surabaya	P.Sepekan	07-00-57S	115-42-44E	20	On Land	42.5	12	1
143	Manado/Bitung	Napu Arampua	04-38-17N	127-04-47E	10	Offshore	43.5	12	1
156	Manado/Bitung	Awit	04-19-30N	126-41-14E	20	On Land	46	4	1
159	Manado/Bitung	Pel.Tamako	03-26-49N	125-29-33E	20	On Land	46	4	1
168	Manado/Bitung	Tg. Papalanpungan	03-58-52N	126-44-38E	30	On Land	40	16	1

Appendix 4.6.1. Result of Air Quality Analysis (Timau)

No	Parameter	Unit	Result	Quality Standard *
1	CO	$\mu g/m^3$	360	10,000
2	NOx	$\mu g/m^3$	1.04	150
3	SO_2	$\mu g/m^3$	1.6	365
4	NH_3	$\mu g/m^3$	1.2	1.36
5	Particle	$\mu g/m^3$	43	260
6	H_2S	$\mu g/m^3$	udt	42

Source : Primary data, Environmental Laboratory PT. Unilab Perdana Jakarta, 2002

Note: udt = undetected

* = Government Regulation No. 41 year 1999 regarding standard for National Ambien Air Quality

Appendix 4.6.2. Noise Level (Timau)

Locations	Unit	Noise
1. Site	dB(A)	38.6
2. 300m from Site	〃	42.3
3. 700m from Site	〃	42.1

Source : Primary data

Appendix 4.6.3. Result of Soil Fertility Analysis (Timau)

No	Parameter	Unit	Result location		
			S_1	S_2	S_3
1	pH				
	- H_2O	-	6.2	5.3	5.7
	- KCl	-	4.4	4.1	4.0
2	C. Organic	%	2.1	3.8	2.7
3	N. Total	%	0.13	0.34	0.09
4	P_2O_5 (HCl 25%	mg/100 gr	1.1	2.6	2.4
5	K_2O (HCl 25%)	mg/100 gr	6.8	8.2	6.6
6	P_2O_3 (Olsen)	ppm	16.9	12.4	19.1
7	Cation Arrangement (NH_3 – ACt)				
	- Ca	me/100 gr	0.3	0.3	0.4
	- Mg	me/100 gr	0.4	0.3	0.2
	- K	me/100 gr	1.2	0.6	1.1
	- Na	me/100 gr	0.1	0.1	0.1
8	Cation Exchange Capacity	me/100 gr	20.76	19.05	19.1
9	Acidity				
	- Al – Exchangeable	me/100 gr	2.31	0.17	0.34
	- H – Exchangeable	me/100 gr	0.09	0.1	0.12
10	Texture				
	- Sand	%	35	34	33
	- Dust	%	30	28	28
	- Clay	%	35	38	39

Source : Primary data, Environmental Laboratory PT. Unilab Perdana Jakarta, 2002

Note- me/100gr = milligram equivalent / 100 gram

Appendix 4.6.4. Result of Seawater Quality Analysis (Timau)

No	PARAMETER	UNIT	QUALITY STANDARD	W_1	W_2	W_3
A	Physics					
1	Temperature	℃	-	29.7	30.2	30.4
2	pH	-	6-9	7.95	8.01	8.01
3	Salinity	%	10%	3.34	3.34	3.33
4	Turbidity	NTU	≦ 30	2	2	2
5	Total Suspended Solid (TSS)	mg/l	≦ 80	2	2	2
B	Chemistry	mg/l				
1	Dissolved Oxygen (DO)	mg/l	> 4	6.5	6.5	6.5
2	BOD	mg/l	≦ 45	4.6	4.6	4.6
3	COD	mg/l	≦ 80	15.4	14	14.5
4	NH_3-N	mg/l	≦ 1	2.68	0.7	0.65
5	NO_2-N	mg/l	Nil	< 0.002	< 0.002	< 0.002
6	Phenol	mg/l	≦ 0.002	< 0.002	< 0.002	< 0.002
7	Total phosphate	mg/l	-	< 0.01	< 0.01	< 0.01
8	Oil and grease	mg/l	≦ 5	< 1	< 1	< 1
9	Cadmium	mg/l	≦ 0.01	< 0.0005	< 0.0005	< 0.0005

Source : Primary data, Environmental Laboratory PT. Unilab Perdana Jakarta, 2002

Note : NTU = Net turbidity unit

< = less than, > = more than

Appendix 4.6.5. Result of Aquatic Biology Analysis (Timau)

Kind	Location / Result		
	W 1	W 2	W 3
Phytoplankton	151	203	93
Zooplankton	10	30	2
Benthos	704	368	688
Total (number / m3)	865	601	783

+Source : Primary data, Environmental Laboratory PT. Unilab Perdana Jakarta, 2002

Appendix4.6.6. Result of Air Quality Analysis (Sading)

No	Parameter	Unit	Result	Quality Standard *
1	CO	$\mu g/m^3$	36	10,000
2	NOx	$\mu g/m^3$	3.04	150
3	SO_2	$\mu g/m^3$	1.6	365
4	NH_3	$\mu g/m^3$	16.98	1.36
5	Particle	$\mu g/m^3$	43	260
6	H_2S	$\mu g/m^3$	udt	42

Source : Primary data, Environmental Laboratory PT. Unilab Perdana Jakarta, 2002

Note : udt = undetected

* = Goverment Regulation No. 41 year 1999 regarding standard for National Ambien Air Quality

Appendix 4.6.7. Noise Level (Sading)

Locations	Unit	Noise
1. Site	dB(A)	39.1
2. 500m from site	〃	40.3
3. 1,000m from site	〃	45.1

Source : Primary data

Appendix 4.6.8. Result of Soil Fertility Analysis (Sading)

No	Parameter	Unit	Result/ location		
			S_1	S_2	S_3
1	pH				
	- H_2O	-	4.9	5.1	4.8
	- KCl	-	4.5	4.7	4.5
2	C. Organic	%	2.6	2.4	2.1
3	N. Total	%	20	16	0.09
4	P_2O_5 (HCl 25%	mg/100 gr	22	19	2.4
5	K_2O (HCl 25%)	mg/100 gr	26	33	30
6	P_2O_3 (Olsen)	ppm	17.9	127	19.1
7	Cation Arrangement (NH_3 – ACt)				
	- Ca	me/100 gr	6.71	6.23	6.33
	- Mg	me/100 gr	1.61	1.13	1.92
	- K	me/100 gr	0.09	0.06	0.07
	- Na	me/100 gr	16	0.09	0.17
8	Cation Exchange Capacity	me/100 gr	93	19.86	20.3
9	Acidity				
	- Al – Exchangeable	me/100 gr	0.25	0.2	0.24
	- H – Exchangeable	me/100 gr	0.01	0.05	0.04
10	Texture				
	- Sand	%	32	31	28
	- Dust	%	31	34	37
	- Clay	%	37	35	35

Source : Primary data, Environmental Laboratory PT. Unilab Perdana Jakarta, 2002

Note- me/100gr = milligram equivalent / 100 gram

Appendix4.6.9. Result of Seawater Quality Analysis (Sading)

No	PARAMETER	UNIT	QUALITY STANDARD	W_1	W_2	W_3
A	Physics					
1	Temperature	℃	-	30.1	29.5	30
2	pH	-	6-9	7.9	8.0	8.2
3	Salinity	%	10%	3.06	3.06	3.41
4	Turbidity	NTU	≦ 30	2	2	2
5	Total Suspended Solid (TSS)	mg/l	≦ 80	3	4	3
B	Chemistry	mg/l				
1	Dissolved Oxygen (DO)	mg/l	> 4	6.1	6.3	6.5
2	BOD	mg/l	≦ 45	7.6	6.8	8.0
3	COD	mg/l	≦ 80	15	16	18.6
4	NH_3-N	mg/l	≦ 1	0.16	0.21	0.4
5	NO_2-N	mg/l	Nil	< 0.002	< 0.002	< 0.002
6	Phenol	mg/l	≦ 0.002	< 0.002	< 0.002	< 0.002
7	Total phosphate	mg/l	-	< 0.01	< 0.01	< 0.01
8	Oil and grease	mg/l	≦ 5	1	0.8	1
9	Cadmium	mg/l	≦ 0.01	< 0.0005	< 0.0005	< 0.0005

Source : Primary data, Environmental Laboratory PT. Unilab Perdana Jakarta, 2002

Appendix4.6.10. Result of Aquatic Biology Analysis (Memburit)

Kind	Location / Result		
	W 1	W 2	W 3
Phytoplankton	166	216	130
Zooplankton	16	35	8
Benthos	714	434	694
Total (number / m3)	896	685	832

Source : Primary data, Environmental Laboratory PT. Unilab Perdana Jakarta, 2002

Appendix4.6.11. Land Usage (Memburit)

Types of usage	Arjasa District (Ha)
1.Rice field with simple irrigation	39
2. Rice field with technical irrigation	-
3. Corn field	56
4. Sweet potato field	6
Total	101

Source : Arjasa District In Numbers,2000

Appendix4.6.12. Result of Air Quality Analysis (Memburit)

No	Parameter	Unit	Result	Quality Standard *
1	CO	$\mu g/m^3$	216	10,000
2	NOx	$\mu g/m^3$	4.11	150
3	SO_2	$\mu g/m^3$	0.93	365
4	NH_3	$\mu g/m^3$	1.3	1.36
5	Particle	$\mu g/m^3$	93	260
6	H_2S	$\mu g/m^3$	udt	42

Source : Primary data, Environmental Laboratory PT. Unilab Perdana Jakarta, 2002

Note : udt = undetected

* = Government Regulation No. 41 year 1999 regarding standard for National Ambient Air Quality

Appendix4.6.13. Noise Level (Memburit)

Locations	Unit	Noise
1. Site	dB(A)	47.3
2. Residential area of Kalisangka Village (1)	〃	51.1
2. Residential area of Kalisangka Village (2)	〃	53.1

Source : Primary data

Appendix4.6.14. Result of Soil Fertility Analysis (Memburit)

No	Parameter	Unit	Result location		
			S_1	S_2	S_3
1	pH				
	- H2O	-	5.1	5.3	6.0
	- KCl	-	4.4	4.7	4.6
2	C. Organic	%	2.1	1.61	1.9
3	N. Total	%	19	14	0.40
4	P_2O_5 (HCl 25%	mg/100 gr	21	18	25
5	K_2O (HCl 25%)	mg/100 gr	24	37	30
6	P_2O_3 (Olsen)	ppm	16.9	12.4	19.1
7	Cation Arrangement (NH_3 – ACt)				
	- Ca	me/100 gr	5.77	6.02	6.33
	- Mg	me/100 gr	1.41	1.13	1.92
	- K	me/100 gr	0.09	0.07	0.07
	- Na	me/100 gr	0.14	0.09	0.15
8	Cation Exchange Capacity	me/100 gr	21.76	18.85	20
9	Acidity				
	- Al – Exchangeable	me/100 gr	0.27	0.11	0.24
	- H – Exchangeable	me/100 gr	0.04	0.05	0.04
10	Texture				
	- Sand	%	37	31	34
	- Dust	%	31	28	35
	- Clay	%	32	41	31

Source : Primary data, Environmental Laboratory PT. Unilab Perdana Jakarta, 2002

Note : me/100gr = milligram equivalent / 100 gram

Appendix4.6.15. Result of Groundwater Analysis (Memburit)

No	PARAMETERS	UNIT	RESULT	QUALITY STANDARD
A	**PHYSICS**			
1	Smell	-	No smell	No smell
2	Total suspended solid (TDS)	mg/l	10	1.500
3	Turbidity	NTU	1	25
4	Taste	-	No taste	No taste
5	Temperature	℃	27.0	Air ± 30℃
6	Colour	Pt-Co	10	50
B	**CHEMICAL**			
1	pH	-	6.1	6.5 – 9.0
2	Mercury (Hg)	mg/l	udt	0.001
3	Arsen (As)	mg/l	< 0.005	0.05
4	Iron (Fe)	mg/l	< 0.03	1.0
5	Fluoride (F)	mg/l	0.07	1.5
6	Cadmium (Cd)	mg/l	udt	0.005
7	Total Hardness ($CaCO_3$)	mg/l	4	500
8	Chlorida (Cl)	mg/l	1.0	600
9	Chromium VI (Cr 6+)	mg/l	< 0.01	0.05
10	Manganese (Mn)	mg/l	< 0.02	0.5
11	Nitrate (NO_3-N)	mg/l	< 0.1	10
12	Nitrite (NO_2-N)	mg/l	0.004	1.0
13	Selenium (Se)	mg/l	< 0.002	0.01
14	Zinc (Zn)	mg/l	0.01	15
15	Cianide (CN)	mg/l	< 0.005	0.1
16	Sulphate (SO_4)	mg/l	0.6	400
17	Surfactan anion (MBAS)	mg/l	0.03	0.5
18	Lead (Pb)	mg/l	< 0.03	0.05
19	Organic substance ($KMnO_4$)	mg/l	22	10

Source : Primary data, Environmental Laboratory PT. Unilab Perdana Jakarta, 2002

Note : < = smaller/lower
udt = undetected
Pt-Co = Platinum-Cobalt method

Appendix4.6.16. Result of Seawater Quality Analysis (Memburit)

No	PARAMETER	UNIT	QUALITY STANDARD	W_1	W_2	W_3
A	Physics					
1	Temperature	℃	-	31	30.5	30.5
2	pH	-	6-9	8.3	8.0	7.9
3	Salinity	%	10%	34.6	40.1	34.1
4	Turbidity	NTU	30	2.2	2.1	2.0
5	Total Suspended Solid (TSS)	mg/l	80	8	7.2	5
B	Chemistry	mg/l				
1	Dissolved Oxygen (DO)	mg/l	> 4	6.1	6.4	6.5
2	BOD	mg/l	≦ 45	40	20.1	35.1
3	COD	mg/l	≦ 80	21	34.2	15
4	NH_3-N	mg/l	≦ 1	0.12	0.23	0.17
5	NO_2-N	mg/l	Nil	< 0.002	< 0.002	< 0.002
6	Phenol	mg/l	≦ 0.002	< 0.002	< 0.002	< 0.002
7	Total phospate	mg/l	-	< 0.01	< 0.01	< 0.01
8	Oil and grease	mg/l	≦ 5	1	0.8	1
9	Cadmium	mg/l	≦ 0.01	< 0.0005	< 0.0005	< 0.0005

Source : Primary data,Environmental Laboratory PT. Unilab Perdana Jakarta, 2002

Note : NTU = Net turbidity unit

< = less than, > = more than

Appendix4.6.17. Result of Aquatic Biology Analysis (Memburit)

Kind	Location / Result		
	W 1	W 2	W 3
Phytoplankton	2,395	29,187	32,491
Zooplankton	6,355	6,394	6,391
Benthos	1,912	1,910	1,915
Total (number / m3)	10,662	37,491	40,797

Source : Primary data,Environmental Laboratory PT. Unilab Perdana Jakarta, 2002

Appendix4.6.18. Result of Air Quality Analysis (Menjangan)

No	Parameter	Unit	Result	Quality Standard *
1	CO	μg/m^3	udt	10,000
2	NOx	μg/m^3	4.12	150
3	SO_2	μg/m^3	0.68	365
4	NH_3	μg/m^3	2.10	1.36
5	Particle	μg/m^3	36	260
6	H_2S	μg/m^3	udt	42

Source : Primary data, Environmental Laboratory PT. Unilab Perdana Jakarta, 2002

Note : udt = undetected

* = Goverment Regulation No. 41 year 1999 regarding standard for National Ambien Air Quality

Appendix4.6.19. Noise Level (Menjangan)

Locations	Unit	Noise
1. Site	dB(A)	50.1
2. 500m from site	〃	55.6
3. 1,000m from site	〃	54.0

Source : Primary data

Appendix4.6.20. Result of Soil Fertility Analysis (Menjangan)

No	Parameter	Unit	Result location		
			S_1	S_2	S_3
1	pH				
	- H_2O	-	5.1	6.1	5.3
	- KCl	-	4.4	4.1	4.0
2	C. Organic	%	4.17	3.1	2.9
3	N. Total	%	0.38	0.37	0.35
4	P_2O_5 (HCl 25%)	mg/100 gr	32	37	39
5	K_2O (HCl 25%)	mg/100 gr	96	79	83
6	P_2O_3 (Olsen)	ppm	16.9	17.1	16.3
7	Cation Arrangement (NH_3 – ACt)				
	- Ca	me/100 gr	4.77	5.3	4.6
	- Mg	me/100 gr	1.41	1.9	1.7
	- K	me/100 gr	0.09	0.11	0.08
	- Na	me/100 gr	0.14	0.17	0.19
8	Cation Exchange Capacity	me/100 gr	21.76	25.1	22.6
9	Acidity				
	- Al – Exchangeable	me/100 gr	32	0.3	0.1
	- H – Exchangeable	me/100 gr	0.04	0.5	0.3
10	Texture				
	- Sand	%	42	35	37
	- Dust	%	48	50	47
	- Clay	%	10	15	26

Source : Primary data, Environmental Laboratory PT. Unilab Perdana Jakarta, 2002

Note : me/100gr = milligram equivalent / 100 gram

Appendix4.6.21. Result of Seawater Quality Analysis (Menjangan)

No	PARAMETER	UNIT	QUALITY STANDARD	W_1	W_2	W_3
A	Physics					
1	Temperature	℃	-	30	38.5	39
2	pH	-	6-9	8.0	8.1	8.0
3	Salinity	%	10%	3.40	3.41	346
4	Turbidity	NTU	30	1	1	1
5	Total Suspended Solid (TSS)	mg/l	80	2	2	2
B	Chemistry	mg/l				
1	Dissolved Oxygen (DO)	mg/l	> 4	6.1	6.4	6.2
2	BOD	mg/l	≦ 45	4.1	4.1	4.1
3	COD	mg/l	≦ 80	16.2	16.2	16
4	NH_3-N	mg/l	≦ 1	0.06	0.06	0.06
5	NO_2-N	mg/l	Nil	0.002	0.002	0.002
6	Phenol	mg/l	≦ 0.002	< 0.002	< 0.002	< 0.002
7	Total phosphate	mg/l	-	< 0.01	< 0.01	< 0.01
8	Oil and grease	mg/l	≦ 5	< 1	< 1	< 1
9	Cadmium	mg/l	≦ 0.01	< 0.0005	< 0.0005	< 0.0005

Source : Primary data, Environmental Laboratory PT. Unilab Perdana Jakarta, 2002

Note : NTU = Net turbidity unit

< = less than, > = more than

Appendix4.6.22. Result of Aquatic Biology Analysis (Menjangan)

Kind	Location / Result		
	W 1	W 2	W 3
Phytoplankton	35,535	35,560	35,568
Zooplankton	10,580	10,591	10,578
Benthos	2,150	2,157	2,185
Total (number / m3)	48,265	48,308	48,331

Source : Primary data, Environmental Laboratory PT. Unilab Perdana Jakarta, 2002

Appendix4.6.23. Land Usage (Merak)

Types of usage	Taman Sari Village (Ha)	Pulo Merak District (Ha)
1.Rice field with simple irrigation	234.42	-
2. Rice field with technical irrigation	50.00	1.723
3. Yards	39.00	1.165
4. Dry fields	50.00	116.357
5. Buildings	67.00	0.256
Total	440.42	119.501

Source : Pulo Merak District in Numbers 2000

Appendix4.6.24. Result of Air Quality Analysis (Merak)

No	Parameter	Unit	Result	Quality Standard *
1	CO	$\mu g/m^3$	228	10,000
2	NOx	$\mu g/m^3$	5.12	150
3	SO_2	$\mu g/m^3$	0.71	365
4	NH_3	$\mu g/m^3$	1.20	1.36
5	Particle	$\mu g/m^3$	61	260
6	H_2S	$\mu g/m^3$	udt	42

Source : Primary data, Environmental Laboratory PT. Unilab Perdana Jakarta, 2002

Note : udt = undetected

* = Government Regulation No. 41 year 1999 regarding standard for National Ambien Air Quality

Appendix4.6.25. Noise Level (Menjangan)

Locations	Unit	Noise
1. Site	dB(A)	47.3
2. Residential area of Taman Sari Village	〃	50.1
3.Residential area of Taman Sari Village	〃	54.6

Source : Primary data

Appendix 4.6.26. Result of Soil Fertility Analysis (Merak)

No	Parameter	Unit	Result location		
			S_1	S_2	S_3
1	pH				
	- H_2O	-	5.1	5.3	6.0
	- KCl	-	4.4	4.7	4.6
2	C. Organic	%	2.1	1.61	1.9
3	N. Total	%	19	14	0.40
4	P_2O_5 (HCl 25%	mg/100 gr	21	18	25
5	K_2O (HCl 25%)	mg/100 gr	24	37	30
6	P_2O_3 (Olsen)	ppm	16.9	12.4	19.1
7	Cation Arangement				
	(NH_3 – ACt)				
	- Ca	me/100 gr	5.77	6.02	6.33
	- Mg	me/100 gr	1.41	1.13	1.92
	- K	me/100 gr	0.09	0.07	0.07
	- Na	me/100 gr	0.14	0.09	0.15
8	Cation Exchange Capacity	me/100 gr	21.76	18.85	20
9	Acidity				
	- Al – Exchangable	me/100 gr	0.27	0.11	0.24
	- H – Exchangable	me/100 gr	0.04	0.05	0.04
10	Texture				
	- Sand	%	37	31	34
	- Dust	%	31	28	35
	- Clay	%	32	41	31

Source : Primary data, Environmental Laboratory PT. Unilab Perdana Jakarta, 2002

Note : me/100gr = milligram equivalent / 100 gram

Appendix4.6.27. Result of Seawater Quality Analysis (Merak)

No	PARAMETER	UNIT	QUALITY STANDARD	W_1	W_2	W_3
A	Physics					
1	Temperature	℃	-	30.6	30.5	30
2	pH	-	6-9	8.24	8.6	8.1
3	Salinity	%	10%	3.08	40.1	3.41
4	Turbidity	NTU	≦ 30	2	2	2
5	Total Suspended Solid (TSS)	mg/l	≦ 80	3	6	3
B	Chemistry	mg/l				
1	Dissolved Oxygen (DO)	mg/l	> 4	5.8	6.3	6.5
2	BOD	mg/l	≦ 45	11.2	20.1	15.1
3	COD	mg/l	≦ 80	48.0	34.2	40
4	NH_3-N	mg/l	≦ 1	0.11	0.21	0.19
5	NO_2-N	mg/l	Nil	< 0.002	< 0.002	< 0.002
6	Phenol	mg/l	≦ 0.002	< 0.002	< 0.002	< 0.002
7	Total phospate	mg/l	-	< 0.01	< 0.01	< 0.01
8	Oil and grease	mg/l	≦ 5	1	0.8	1
9	Cadmium	mg/l	≦ 0.01	< 0.0005	< 0.0005	< 0.0005

Source : Primary data, Environmental Laboratory PT. Unilab Perdana Jakarta, 2002

Note : NTU = Net turbidity unit

< = less than, > = more than

Appendix4.6.28. Result of Aquatic Biology Analysis (Merak)

Kind	Location / Result		
	W 1	W 2	W 3
Phytoplankton	30,586	30,579	30,563
Zooplankton	5,904	5,905	5,902
Benthos	1,750	1,748	1,747
Total (number / m3)	38,240	38,232	38,212

Source : Primary data, Environmental Laboratory PT. Unilab Perdana Jakarta, 2002

Appendix4.6.29. Land Usage (Tanglad)

Types of usage	Tanglad Village (Ha)	Nusa Penida District (Ha)
1.Rice field with simple irrigation	-	-
2. Rice field with technical irrigation	-	-
3. Yards	0.75	1.165
4. Dry fields	31	116.357
5. Buildings	0.75	0.256
Total	32.50	117.778

Source : Nusa Penida District in Numbers (2000)

Appendix4.6.30. Result of Air Quality Analysis (Tanglad)

No	Parameter	Unit	Result	Quality Standard *
1	CO	$\mu g/m^3$	udt	10
2	NOx	$\mu g/m^3$	2.05	150
3	SO_2	$\mu g/m^3$	udt	365
4	NH_3	$\mu g/m^3$	1.66	1,360
5	Particle	$\mu g/m^3$	27	260
6	H_2S	$\mu g/m^3$	udt	40

Source : Primary data, Environmental Laboratory PT. Unilab Perdana Jakarta, 2002

Note : udt = undetected

* = Government Regulation No. 41 year 1999 regarding standard for National Ambien Air Quality

Appendix4.6.31. Noise Level (Tanglad)

Locations	Unit	Noise
1. Radar site plan	dB(A)	43.3
2. Residential area of Tanglad Village (1)	〃	44.3
3. Residential area of Tanglad Village (2)	〃	51.0

Source : Primary data

Appendix4.6.32. Result of Soil Fertility Analysis (Tanglad)

No	Parameter	Unit	Result location		
			S_1	S_2	S_3
1	pH				
	- H_2O	-	5.1	6.8	6.2
	- KCl	-	4.4	4.0	4.6
2	C. Organic	%	4.17	4.21	4.10
3	N. Total	%	0.38	0.19	0.40
4	P_2O_5 (HCl 25%	mg/100 gr	32	34	31
5	K_2O (HCl 25%)	mg/100 gr	96	80	59
6	P_2O_3 (Olsen)	ppm	16.9	20	19.1
7	Cation Arrangement (NH_3 – ACt)				
	- Ca	me/100 gr	4.77	4.6	4.33
	- Mg	me/100 gr	1.41	2.1	1.92
	- K	me/100 gr	0.09	0.11	0.07
	- Na	me/100 gr	0.14	0.17	0.15
8	Cation Exchange Capacity	me/100 gr	21.76	30.1	24.2
9	Acidity				
	- Al – Exchangeable	me/100 gr	0.32	0.25	0.24
	- H – Exchangeable	me/100 gr	0.04	0.04	0.04
10	Texture				
	- Sand	%	42	43	42
	- Dust	%	48	48	38
	- Clay	%	10	9	20

Source : Primary data, Environmental Laboratory PT. Unilab Perdana Jakarta, 2002

Note : me/100gr = milligram equivalent / 100 gram

Appendix 5.1.1.

Number of Collisions by with/without Case for Aids to Navigation

(Ships / Year)

Year	Number of Collisions		
	Without Case	With Case	Difference
2007	91.94	82.69	9.2
2008	107.93	97.05	10.9
2009	123.92	111.41	12.5
2010	139.91	125.76	14.1
2011	155.90	140.12	15.8
2012	171.89	154.48	17.4
2013	187.88	168.83	19.0
2014	203.87	183.19	20.7
2015	219.86	197.55	22.3
2016	235.86	211.90	24.0
2017	251.85	226.26	25.6
2018	267.84	240.62	27.2
2019	283.83	254.97	28.9
2020	299.82	269.33	30.5
2021	315.81	283.68	32.1
2022	331.80	298.04	33.8
2023	347.79	312.40	35.4
2024	363.78	326.75	37.0
2025	379.77	341.11	38.7
2026	395.77	355.47	40.3
2027	411.76	369.82	41.9
2028	427.75	384.18	43.6
2029	443.74	398.54	45.2
2030	459.73	412.89	46.8
2031	475.72	427.25	48.5
2032	491.71	441.60	50.1
2033	507.70	455.96	51.7
2034	523.69	470.32	53.4
2035	539.68	484.67	55.0
2036	555.68	499.03	56.6

Appendix 5.1.2.
Damage and Loss per Vessel

1. Outline of Indonesian vessel

Table 1. Summary of Indonesian Vessels

No.	Type	Number of vessels (Ships)	Average GT (Ton)	Average DWT (Ton)	Average Age (Years)	Ship's Price (USD)	H/B (USD)
1	Bulk Carrier	28	13,569.78	21,991.28	22.48	1,750,000	505,562
2	Dry Cargo / Passenger	1,324	1,486.78	2,311.18	25.72	200,000	92,392
3	Fishing	338	241.00	262.89	28.08	21,219	10,509
4	Miscellaneous	529	349.10	619.52	21.08	34,676	24,766
5	Non-merchant	6	1,631.00	-	20.83	194,247	0
6	Offshore	54	626.00	916.38	23.43	69,144	36,633
7	Tanker	288	3,073.92	5,639.51	25.90	300,000	225,446
	Total / Average	2,567	1,379.84	2,839.64	25.14	167,750	85,720

Source: Lloyds Register of Shipping, 2000
Price: PT.Samudera Indonesia & The Study Team
H/B : The study team

2. Ship's damage Ratio

When vessel collides, damage ratio is shown in **Table 2**. Average age of vessels is very old in Indonesia, so that total damage and half damage are considered 100% damage and light damage is considered 25% damage.

Table 2. Damage Ratio of Indonesian Vessels

	Ratio (%)	Passenger	Cargo Boat	Tanker	Fishing	Leisure	Tug	Etc	Total	
Total Damage	100	1	5	0	9	10	3	0	28	6.0%
Heavy Damage	100	1	21	4	15	8	3	2	54	11.5%
Light Damage	25	19	226	34	56	21	26	6	388	82.6%
Total		21	252	38	80	39	32	8	470	100.0%
							Average Damage Ratio			0.3815

Note: 1994 January ~ 1998 December

Source: Marine Accident Inquiry Agency

3. Damage when an Indonesian vessel collides

Total damage and heavy damage are scrapped and light damage calculated as follows.

167,750 x 0.3815 = 63,997 US$ / vessel

4. Cargo damage

2,839.64 x 34 x 0.3815 = 36,833 US$

5. Inoperable loss

Hire Base should be used for inoperable loss. In case of light loss, inoperable loss is 7 days. When average Indonesian vessel collides, inoperable loss/vessel are as follows.

85,720 x 0.826 x 7 days = 495,633 US$ / vessel

6. Damage of oil spill from tanker

(a) Probability of oil spill

When tanker collides, probability of oil spill is shown in **Table 3**.

Table 3. Probability of Oil Spill When Tankers collides.

	1977	1978	1979	1980	1981	1982	Total
All Collision	14	14	5	27	9	11	80
Collision with oil spill	7	1	5	11	2	4	30

Source: The study on the safety improvement of the Suez Canal in the Arab Republic of Egypt, JICA

According to **Table 3.**, probability of oil spill is as follows.

30/80=0.375

(b) Amount of spilling oil

$Q=0.018K^{1.19}$ (formula 1)

$K=28.5Q^{0.838}$ (formula 2)

Where

Q: Amount of oil spills

K: Tanker size (G.T.)

Spilling oil quantity, when an average Indonesian tanker collides, should be calculated by formula 1.

$0.018 \times 3{,}073.92^{1.19} = 95.4$ Kl 78.5MT

(Source: The study on the safety improvement of the Suez Canal in the Arab Republic of Egypt, JICA)

Percentage of Indonesian tankers among all vessels is 11.22%; Spilling oil from average Indonesian vessels should be calculated as follows.

0.1122 x 78.5 = 8.81 MT

(c) Clean up cost

Clean up cost should be calculated as follows.

3,830 x 8.81 = 33,743 US$

(Source: Manual on oil pollution, Section Ⅳ, Combating oil spill, IMO)

(d) Compensation expense

Compensation expense was calculated referring to off Singapore oil spill.

(Compensation Expense 25,230,000 S$ against 29,000 ton of oil spill.)

401 x 8.81 = 3,533 US$

7. Total Damage

Total damages are shown in **Table 4.**

Table 4. Total Damage

	Amount loss (US$)
Damage by collision (Hull)	63,997
Damage by collision (Cargo)	36,833
Inoperable loss	495,633
Oil spill, clean up cost	33,743
Compensation	3,533
Total Loss	633,739

Appendix 5.1.3.

Number of Collisions by with/without Case for VTS

(Ships / Year)

Year	Number of Collision		
	Without Case	With Case	Difference
2004	15.16	12.13	3.0
2005	17.38	13.90	3.5
2006	19.93	15.94	4.0
2007	22.86	18.28	4.6
2008	26.21	20.97	5.2
2009	30.05	24.04	6.0
2010	34.46	27.57	6.9
2011	39.52	31.61	7.9
2012	45.32	36.25	9.1
2013	51.97	41.57	10.4
2014	59.59	47.67	11.9
2015	68.33	54.66	13.7
2016	78.36	62.68	15.7
2017	89.86	71.88	18.0
2018	103.04	82.43	20.6
2019	118.16	94.52	23.6
2020	135.49	108.39	27.1
2021	155.37	124.29	31.1
2022	178.17	142.52	35.6

Appendix 5.2.1

Financial Analysis for Visual Aids to Navigation and Supporting Facilities

(Interest Rate: Market Rate 6 %, Evaluation Period: 10 years)

Light Dues 19.78% Units : Million USD

period	No	Year	TTL Cost (Visual Aids to Navigation and Supporting Facilities)							Revenue					
			Civil	Consultant	Initial Cost Total	Operating & Maintenance	Grand Total	Funds (Initial Cost) 15%	Grand Total-Funds	GDP: Likeliest Case Light Dues		GDP: Optimistic Case Light Dues		GDP: Pessimistic Case Light Dues	
			1	2	3=1+2	4	5=3+4	6=3 x 0.15	7=5-6	8	9=8-7	10	11=10-7	12	13=12-7
	1	2000													
	2	2001													
	3	2002													
	4	2003								3.002	3.002	3.133	3.133	2.874	2.874
	5	2004		0.597	0.597		0.597	0.090	0.508	3.255	2.748	3.472	2.964	3.050	2.542
	6	2005	8.832	0.398	9.230		9.230	1.384	7.845	3.531	-4.314	3.848	-3.997	3.237	-4.608
	7	2006	6.987	0.597	7.584		7.584	1.138	6.447	3.831	-2.616	4.266	-2.181	3.436	-3.011
1	8	2007	7.058	0.398	7.456		7.456	1.118	6.338	4.156	-2.181	4.730	-1.608	3.647	-2.691
2	9	2008				0.030	0.030		0.030	4.510	4.481	5.245	5.216	3.872	3.842
3	10	2009				0.082	0.082		0.082	4.895	4.813	5.818	5.737	4.111	4.029
4	11	2010				0.042	0.042		0.042	5.314	5.272	6.455	6.414	4.365	4.323
5	12	2011				0.290	0.290		0.290	5.640	5.350	6.967	6.677	4.555	4.265
6	13	2012				1.081	1.081		1.081	5.986	4.906	7.519	6.438	4.754	3.674
7	14	2013				0.082	0.082		0.082	6.354	6.272	8.114	8.032	4.962	4.880
8	15	2014				0.069	0.069		0.069	6.744	6.675	8.757	8.688	5.179	5.110
9	16	2015				0.680	0.680		0.680	7.158	6.478	9.451	8.771	5.405	4.725
10	17	2016				0.042	0.042		0.042	7.598	7.556	10.200	10.158	5.641	5.599
			22.877	1.990	24.867	2.397	27.264	3.730	23.534	71.975	48.441	87.976	64.442	59.087	35.553
						FIRR					6.00%		9.10%		3.16%

Appendix 5.2.2

Financial Analysis for DGPS

(Interest Rate: Market Rate 6 %, Evaluation Period: 10 year s)

Light Dues 3.78% : Million USD

period	No	Year	TTL Cost (DGPS)							Revenue					
			Civil	Consultant	Initial Cost Total	Operating & Maintenance	Grand Total	Funds (Initial Cost) 15%	Grand Total-Funds	GDP: Likeliest Case		GDP: Optimistic Case		GDP: Pessimistic Case	
										Light Dues		Light Dues		Light Dues	
			1	2	3=1+2	4	5=3+4	6=3 x 0.15	7=5-6	8	9=8-7	10	11=10-7	12	13=12-7
	1	2000													
	2	2001													
	3	2002													
	4	2003								0.574	0.574	0.599	0.599	0.550	0.550
	5	2004								0.622	0.622	0.664	0.664	0.583	0.583
	6	2005								0.675	0.675	0.736	0.736	0.619	0.619
	7	2006		0.161	0.161		0.161	0.024	0.137	0.732	0.596	0.816	0.679	0.657	0.520
1	8	2007	4.681	0.121	4.801		4.801	0.720	4.081	0.795	-3.287	0.904	-3.177	0.697	-3.384
2	9	2008	0.565	0.121	0.686		0.686	0.10288	0.583	0.862	0.279	1.003	0.420	0.740	0.157
3	10	2009				0.027	0.027		0.027	0.936	0.909	1.113	1.086	0.786	0.759
4	11	2010				0.027	0.027		0.027	1.016	0.989	1.234	1.208	0.835	0.808
5	12	2011				0.027	0.027		0.027	1.078	1.052	1.332	1.306	0.871	0.844
6	13	2012				0.027	0.027		0.027	1.145	1.118	1.438	1.411	0.909	0.883
7	14	2013				0.027	0.027		0.027	1.215	1.188	1.551	1.525	0.949	0.922
8	15	2014				0.027	0.027		0.027	1.290	1.263	1.674	1.648	0.990	0.964
9	16	2015				0.027	0.027		0.027	1.369	1.342	1.807	1.781	1.034	1.007
10	17	2016				0.027	0.027		0.027	1.453	1.426	1.950	1.924	1.079	1.052
			5.246	0.402	5.648	0.212	5.860	0.847	5.013	13.762	8.749	16.822	11.809	11.298	6.285
						FIRR					6.00%		10.57%		2.03%

Appendix 5.2.3
Financial Analysis for VTS System
(Interest Rate: Market Rate 6 %, Evaluation Period: 10 years)

Light Dues 5.15% Units : Million USD

period	No	Year	TTL Cost (VTS System)							Revenue					
			Civil	Consultant	Initial Cost Total	Operating & Maintenance	Grand Total	Funds (Initial Cost) 15%	Grand Total-Funds	GDP: Likeliest Case Light Dues		GDP: Optimistic Case Light Dues		GDP: Pessimistic Case Light Dues	
			1	2	3=1+2	4	5=3+4	6=3 x 0.15	7=5-6	8	9=8-7	10	11=10-7	12	13=12-7
	1	2000													
	2	2001													
	3	2002													
	4	2003								0.782	0.782	0.816	0.816	0.748	0.748
	5	2004	0.952	0.261	1.213		1.213	0.182	1.031	0.848	-0.183	0.904	-0.127	0.794	-0.237
	6	2005	1.622	0.195	1.817		1.817	0.273	1.545	0.920	-0.625	1.002	-0.543	0.843	-0.702
	7	2006	2.290	0.130	2.420		2.420	0.363	2.057	0.998	-1.060	1.111	-0.947	0.895	-1.163
1	8	2007	0.540	0.065	0.605		0.605	0.091	0.514	1.082	0.568	1.232	0.717	0.950	0.435
2	9	2008				0.075	0.075		0.075	1.174	1.100	1.366	1.291	1.008	0.934
3	10	2009				0.075	0.075		0.075	1.275	1.200	1.515	1.441	1.070	0.996
4	11	2010				0.075	0.075		0.075	1.384	1.309	1.681	1.606	1.137	1.062
5	12	2011				0.075	0.075		0.075	1.469	1.394	1.814	1.739	1.186	1.112
6	13	2012				0.075	0.075		0.075	1.559	1.484	1.958	1.883	1.238	1.163
7	14	2013				0.075	0.075		0.075	1.655	1.580	2.113	2.038	1.292	1.217
8	15	2014				0.075	0.075		0.075	1.756	1.682	2.280	2.206	1.349	1.274
9	16	2015				0.075	0.075		0.075	1.864	1.789	2.461	2.386	1.407	1.333
10	17	2016				0.075	0.075		0.075	1.979	1.904	2.656	2.581	1.469	1.394
			5.404	0.652	6.056	0.672	6.728	0.908	5.819	18.742	12.923	22.909	17.090	15.386	9.567
						FIRR					6.00%		8.61%		3.50%

Appendix 5.2.4

Financial Analysis for GMDSS

(Interest Rate: Market Rate 6 %, Evaluation Period: 10 years)

Light Dues 32.40% Units : Million USD

period	No	Year	TTL Cost (GMDSS)							Revenue					
			Civil	Consultant	Initial Cost Total	Operating & Maintenance	Grand Total	Funds (Initial Cost) 15%	Grand Total-Funds	GDP: Likeliest Case		GDP: Optimistic Case		GDP: Pessimistic Case	
										Light Dues		Light Dues		Light Dues	
			1	2	3=1+2	4	5=3+4	6=3 x 0.15	7=5-6	8	9=8-7	10	11=10-7	12	13=12-7
	1	2000													
	2	2001													
	3	2002													
	4	2003		0.689	0.689		0.689	0.103	0.586	4.917	4.331	5.132	4.547	4.708	4.122
	5	2004		0.862	0.862		0.862	0.129	0.732	5.332	4.600	5.687	4.955	4.996	4.263
	6	2005	13.784	0.862	14.646		14.646	2.197	12.449	5.784	-6.665	6.303	-6.146	5.302	-7.147
	7	2006	15.507	0.689	16.196		16.196	2.429	13.767	6.274	-7.492	6.987	-6.780	5.628	-8.139
1	8	2007	6.892	0.517	7.409	0.361	7.770	1.111	6.658	6.808	0.149	7.747	1.089	5.974	-0.685
2	9	2008				0.361	0.361		0.361	7.388	7.027	8.592	8.231	6.342	5.981
3	10	2009				0.361	0.361		0.361	8.018	7.657	9.530	9.169	6.733	6.372
4	11	2010				0.361	0.361		0.361	8.703	8.342	10.574	10.213	7.149	6.788
5	12	2011				0.361	0.361		0.361	9.238	8.877	11.411	11.050	7.461	7.100
6	13	2012				0.361	0.361		0.361	9.805	9.444	12.315	11.954	7.787	7.426
7	14	2013				0.361	0.361		0.361	10.407	10.046	13.290	12.930	8.127	7.766
8	15	2014				0.361	0.361		0.361	11.046	10.686	14.344	13.983	8.482	8.122
9	16	2015				0.361	0.361		0.361	11.725	11.364	15.480	15.119	8.853	8.492
10	17	2016				0.361	0.361		0.361	12.445	12.085	16.707	16.346	9.240	8.879
			36.183	3.618	39.801	3.609	43.410	5.970	37.440	117.890	80.450	144.098	106.658	96.781	59.341
						FIRR					6.00%		8.87%		3.34%

Appendix 5.2.5
Financial Analysis for Ship Reporting System
(Interest Rate: Market Rate 6 %, Evaluation Period: 10 years)

Light Dues 8.14% Units : Million USD

period	No	Year	TTL Cost (Ship Reporting System)							Revenue					
			Civil	Consultant	Initial Cost Total	Operating & Maintenance	Grand Total	Funds (Initial Cost) 15%	Grand Total-Funds	GDP: Likeliest Case		GDP: Optimistic Case		GDP: Pessimistic Case	
										Light Dues		Light Dues		Light Dues	
			1	2	3=1+2	4	5=3+4	6=3 x 0.15	7=5-6	8	9=8-7	10	11=10-7	12	13=12-7
	1	2000													
	2	2001													
	3	2002													
	4	2003								1.235	1.235	1.289	1.289	1.182	1.182
	5	2004								1.339	1.339	1.428	1.428	1.254	1.254
	6	2005		0.297	0.297		0.297	0.045	0.253	1.452	1.199	1.583	1.330	1.331	1.079
	7	2006	1.982	0.297	2.280		2.280	0.342	1.938	1.575	-0.362	1.754	-0.183	1.413	-0.525
1	8	2007	5.452	0.297	5.749		5.749	0.862	4.887	1.709	-3.177	1.945	-2.941	1.500	-3.387
2	9	2008	2.974	0.149	3.122	0.139	3.261	0.46834	2.793	1.855	-0.938	2.157	-0.635	1.592	-1.200
3	10	2009				0.139	0.139		0.139	2.013	1.875	2.393	2.254	1.691	1.552
4	11	2010				0.139	0.139		0.139	2.185	2.047	2.655	2.516	1.795	1.656
5	12	2011				0.139	0.139		0.139	2.320	2.181	2.865	2.727	1.873	1.735
6	13	2012				0.139	0.139		0.139	2.462	2.323	3.092	2.954	1.955	1.817
7	14	2013				0.139	0.139		0.139	2.613	2.475	3.337	3.199	2.041	1.902
8	15	2014				0.139	0.139		0.139	2.774	2.635	3.602	3.463	2.130	1.991
9	16	2015				0.139	0.139		0.139	2.944	2.806	3.887	3.748	2.223	2.084
10	17	2016				0.139	0.139		0.139	3.125	2.986	4.195	4.056	2.320	2.182
			10.408	1.041	11.448	1.247	12.696	1.717	10.979	29.602	18.623	36.183	25.204	24.301	13.323
						FIRR					6.00%		13.57%		1.85%

Appendix 5.2.6
Financial Analysis for Total Projects
(Interest Rate: Market Rate 6 %, Evaluation Period: 10 years)

Light Dues 69.25% Units : Million USD

period	No	Year	TTL Cost (All Projects)							Revenue					
			Civil	Consultant	Initial Cost Total	Operating & Maintenance	Grand Total	Funds (Initial Cost)	Loan (Initial Cost)	GDP: Likeliest Case		GDP: Optimistic Case		GDP: Pessimistic Case	
								15%	85%	Light Dues		Light Dues		Light Dues	
			1	2	3=1+2	4	5=3+4	6	7=5-6	8	9=8-7	10	11=10-7	12	13=12-7
	1	2000													
	2	2001													
	3	2002													
	4	2003		0.689	0.689		0.689	0.103	0.586	10.509	9.923	10.970	10.384	10.062	9.476
	5	2004	0.952	1.720	2.672		2.672	0.401	2.271	11.397	9.126	12.155	9.884	10.678	8.407
	6	2005	24.238	1.752	25.990		25.990	3.898	22.091	12.362	-9.729	13.471	-8.620	11.332	-10.759
	7	2006	26.767	1.875	28.641		28.641	4.296	24.345	13.411	-10.935	14.933	-9.412	12.028	-12.317
1	8	2007	24.623	1.398	26.021	0.361	26.381	3.903	22.478	14.551	-7.928	16.558	-5.920	12.768	-9.711
2	9	2008	3.539	0.269	3.808	0.604	4.412	0.571	3.841	15.790	11.949	18.363	14.523	13.554	9.714
3	10	2009				0.682	0.682		0.682	17.137	16.455	20.369	19.687	14.390	13.708
4	11	2010				0.643	0.643		0.643	18.602	17.959	22.599	21.957	15.279	14.637
5	12	2011				0.891	0.891		0.891	19.744	18.853	24.389	23.498	15.947	15.056
6	13	2012				1.681	1.681		1.681	20.956	19.275	26.321	24.640	16.644	14.962
7	14	2013				0.682	0.682		0.682	22.244	21.561	28.406	27.724	17.371	16.688
8	15	2014				0.670	0.670		0.670	23.610	22.940	30.657	29.987	18.130	17.460
9	16	2015				1.281	1.281		1.281	25.060	23.780	33.087	31.806	18.922	17.642
10	17	2016				0.643	0.643		0.643	26.600	25.958	35.709	35.066	19.749	19.107
			80.118	7.703	87.821	8.137	95.958	13.173	82.785	251.972	169.187	307.988	225.203	206.855	124.070
									FIRR		6.00%		9.18%		3.11%

Appendix 5.2.7

Financial Analysis for Visual Aids to Navigation and Supporting Facilities

(Interest Rate: Market Rate 6 %, Evaluation Period: 30 years)

Light Dues 13.74% Units : Million USD

period	No	Year	TTL Cost (Visual Aids to Navigation and Supporting Facilities)							Revenue					
			Civil	Consultant	Initial Cost Total	Operating & Maintenance	Grand Total	Funds (Initial Cost) 15%	Grand Total-Funds	GDP: Likeliest Case		GDP: Optimistic Case		GDP: Pessimistic Case	
										Light Dues		Light Dues		Light Dues	
			1	2	3=1+2	4	5=3+4	6=3 x 0.15	7=5-6	8	9=8-7	10	11=10-7	12	13=12-7
	1	2000													
	2	2001													
	3	2002													
	4	2003								2.085	2.085	2.177	2.177	1.996	1.996
	5	2004		0.597	0.597		0.597	0.090	0.508	2.261	1.754	2.412	1.904	2.119	1.611
	6	2005	8.832	0.398	9.230		9.230	1.384	7.845	2.453	-5.392	2.673	-5.172	2.249	-5.597
	7	2006	6.987	0.597	7.584		7.584	1.138	6.447	2.661	-3.786	2.963	-3.484	2.387	-4.060
1	8	2007	7.058	0.398	7.456		7.456	1.118	6.338	2.887	-3.450	3.285	-3.052	2.533	-3.804
2	9	2008				0.030	0.030		0.030	3.133	3.103	3.644	3.614	2.689	2.660
3	10	2009				0.082	0.082		0.082	3.400	3.319	4.042	3.960	2.855	2.774
4	11	2010				0.042	0.042		0.042	3.691	3.649	4.484	4.442	3.032	2.990
5	12	2011				0.290	0.290		0.290	3.918	3.628	4.839	4.549	3.164	2.874
6	13	2012				1.081	1.081		1.081	4.158	3.078	5.223	4.142	3.302	2.222
7	14	2013				0.082	0.082		0.082	4.414	4.332	5.636	5.555	3.447	3.365
8	15	2014				0.069	0.069		0.069	4.685	4.615	6.083	6.014	3.597	3.528
9	16	2015				0.680	0.680		0.680	4.973	4.292	6.565	5.885	3.755	3.075
10	17	2016				0.042	0.042		0.042	5.278	5.236	7.085	7.044	3.919	3.877
11	18	2017				4.149	4.149		4.149	5.602	1.453	7.647	3.498	4.090	-0.059
12	19	2018				0.042	0.042		0.042	5.947	5.905	8.253	8.211	4.269	4.227
13	20	2019				0.288	0.288		0.288	6.312	6.024	8.908	8.620	4.455	4.167
14	21	2020				0.042	0.042		0.042	6.700	6.658	9.614	9.572	4.650	4.608
15	22	2021				0.325	0.325		0.325	7.112	6.788	10.377	10.052	4.854	4.529
16	23	2022				1.097	1.097		1.097	7.550	6.453	11.200	10.103	5.066	3.969
17	24	2023				0.304	0.304		0.304	8.014	7.710	12.088	11.784	5.288	4.983
18	25	2024				0.042	0.042		0.042	8.507	8.465	13.047	13.005	5.519	5.477
19	26	2025				0.290	0.290		0.290	9.030	8.740	14.083	13.793	5.760	5.470
20	27	2026				0.042	0.042		0.042	9.586	9.544	15.200	15.158	6.012	5.971
21	28	2027				7.992	7.992		7.992	10.175	2.183	16.407	8.414	6.276	-1.717
22	29	2028				0.025	0.025		0.025	10.801	10.776	17.709	17.684	6.550	6.525
23	30	2029				0.290	0.290		0.290	11.466	11.176	19.115	18.825	6.837	6.547
24	31	2030				0.042	0.042		0.042	12.172	12.130	20.633	20.591	7.136	7.094
25	32	2031				0.304	0.304		0.304	12.921	12.617	22.272	21.967	7.449	7.145
26	33	2032				1.097	1.097		1.097	13.717	12.620	24.041	22.944	7.775	6.678
27	34	2033				0.289	0.289		0.289	14.561	14.272	25.950	25.661	8.115	7.826
28	35	2034				0.042	0.042		0.042	15.458	15.416	28.012	27.970	8.471	8.429
29	36	2035				0.339	0.339		0.339	16.410	16.071	30.237	29.899	8.842	8.503
30	37	2036				0.042	0.042		0.042	17.420	17.378	32.640	32.598	9.229	9.187
			22.877	1.990	24.867	19.480	44.347	3.730	40.617	259.458	218.841	408.544	367.927	167.688	127.071
						FIRR					6.00%		7.92%		4.05%

Appendix 5.2.8
Financial Analysis for DGPS
(Interest Rate: Market Rate 6 %, Evaluation Period: 30 years)

Light Dues 2.89% ; : Million USD

period	No	Year	TTL Cost (DGPS)							Revenue					
			Civil	Consultant	Initial Cost Total	Operating & Maintenance	Grand Total	Funds (Initial Cost) 15%	Grand Total-Funds	GDP: Likeliest Case		GDP: Optimistic Case		GDP: Pessimistic Case	
										Light Dues		Light Dues		Light Dues	
			1	2	3=1+2	4	5=3+4	6=3 x 0.15	7=5-6	8	9=8-7	10	11=10-7	12	13=12-7
	1	2000													
	2	2001													
	3	2002													
	4	2003								0.438	0.438	0.458	0.458	0.420	0.420
	5	2004								0.475	0.475	0.507	0.507	0.445	0.445
	6	2005								0.516	0.516	0.562	0.562	0.473	0.473
	7	2006		0.161	0.161		0.161	0.024	0.137	0.560	0.423	0.623	0.486	0.502	0.365
1	8	2007	4.681	0.121	4.801		4.801	0.720	4.081	0.607	-3.474	0.691	-3.390	0.533	-3.549
2	9	2008	0.565	0.121	0.686		0.686	0.10288	0.583	0.659	0.076	0.766	0.183	0.565	-0.017
3	10	2009				0.027	0.027		0.027	0.715	0.688	0.850	0.823	0.600	0.574
4	11	2010				0.027	0.027		0.027	0.776	0.750	0.943	0.916	0.637	0.611
5	12	2011				0.027	0.027		0.027	0.824	0.797	1.018	0.991	0.665	0.639
6	13	2012				0.027	0.027		0.027	0.874	0.848	1.098	1.072	0.694	0.668
7	14	2013				0.027	0.027		0.027	0.928	0.902	1.185	1.159	0.725	0.698
8	15	2014				0.027	0.027		0.027	0.985	0.959	1.279	1.253	0.756	0.730
9	16	2015				0.027	0.027		0.027	1.046	1.019	1.380	1.354	0.789	0.763
10	17	2016				0.027	0.027		0.027	1.110	1.083	1.490	1.463	0.824	0.797
11	18	2017				0.027	0.027		0.027	1.178	1.151	1.608	1.581	0.860	0.833
12	19	2018				0.027	0.027		0.027	1.250	1.224	1.735	1.709	0.898	0.871
13	20	2019				0.027	0.027		0.027	1.327	1.301	1.873	1.846	0.937	0.910
14	21	2020				0.027	0.027		0.027	1.409	1.382	2.021	1.995	0.978	0.951
15	22	2021				0.187	0.187		0.187	1.495	1.308	2.182	1.995	1.021	0.833
16	23	2022				4.828	4.828		4.828	1.587	-3.241	2.355	-2.473	1.065	-3.763
17	24	2023				0.712	0.712		0.712	1.685	0.973	2.542	1.829	1.112	0.399
18	25	2024				0.027	0.027		0.027	1.789	1.762	2.743	2.717	1.160	1.134
19	26	2025				0.027	0.027		0.027	1.899	1.872	2.961	2.935	1.211	1.185
20	27	2026				0.027	0.027		0.027	2.015	1.989	3.196	3.170	1.264	1.238
21	28	2027				0.027	0.027		0.027	2.139	2.113	3.450	3.423	1.320	1.293
22	29	2028				0.027	0.027		0.027	2.271	2.245	3.724	3.697	1.377	1.351
23	30	2029				0.027	0.027		0.027	2.411	2.384	4.019	3.993	1.438	1.411
24	31	2030				0.027	0.027		0.027	2.559	2.533	4.338	4.312	1.500	1.474
25	32	2031				0.027	0.027		0.027	2.717	2.690	4.683	4.656	1.566	1.540
26	33	2032				0.027	0.027		0.027	2.884	2.858	5.055	5.028	1.635	1.608
27	34	2033				0.027	0.027		0.027	3.062	3.035	5.456	5.430	1.706	1.680
28	35	2034				0.027	0.027		0.027	3.250	3.224	5.890	5.863	1.781	1.755
29	36	2035				0.027	0.027		0.027	3.450	3.424	6.358	6.331	1.859	1.833
30	37	2036				0.027	0.027		0.027	3.663	3.636	6.863	6.837	1.941	1.914
			5.246	0.402	5.648	6.390	12.038	0.847	11.191	54.555	43.363	85.902	74.711	35.259	24.068
						FIRR					6.00%		8.86%		3.23%

Appendix 5.2.9
Financial Analysis for VTS System
(Interest Rate: Market Rate 6 %, Evaluation Period: 30 years)

Light Dues 3.96% Units : Million USD

period	No	Year	TTL Cost (VTS System)							Revenue					
			Civil	Consultant	Initial Cost Total	Operating & Maintenance	Grand Total	Funds (Initial Cost) 15%	Grand Total-Funds	GDP: Likeliest Case Light Dues		GDP: Optimistic Case Light Dues		GDP: Pessimistic Case Light Dues	
			1	2	3=1+2	4	5=3+4	6=3 x 0.15	7=5-6	8	9=8-7	10	11=10-7	12	13=12-7
	1	2000													
	2	2001													
	3	2002													
	4	2003								0.601	0.601	0.627	0.627	0.575	0.575
	5	2004	0.952	0.261	1.213		1.213	0.182	1.031	0.652	-0.379	0.695	-0.336	0.610	-0.421
	6	2005	1.622	0.195	1.817		1.817	0.273	1.545	0.707	-0.838	0.770	-0.775	0.648	-0.897
	7	2006	2.290	0.130	2.420		2.420	0.363	2.057	0.767	-1.291	0.854	-1.204	0.688	-1.370
1	8	2007	0.540	0.065	0.605		0.605	0.091	0.514	0.832	0.317	0.947	0.432	0.730	0.215
2	9	2008				0.075	0.075		0.075	0.903	0.828	1.050	0.975	0.775	0.700
3	10	2009				0.075	0.075		0.075	0.980	0.905	1.164	1.090	0.823	0.748
4	11	2010				0.075	0.075		0.075	1.063	0.989	1.292	1.217	0.874	0.799
5	12	2011				0.075	0.075		0.075	1.129	1.054	1.394	1.320	0.912	0.837
6	13	2012				0.075	0.075		0.075	1.198	1.123	1.505	1.430	0.951	0.877
7	14	2013				0.075	0.075		0.075	1.272	1.197	1.624	1.549	0.993	0.918
8	15	2014				0.075	0.075		0.075	1.350	1.275	1.753	1.678	1.036	0.962
9	16	2015				0.075	0.075		0.075	1.433	1.358	1.891	1.817	1.082	1.007
10	17	2016				0.075	0.075		0.075	1.521	1.446	2.041	1.967	1.129	1.054
11	18	2017				0.075	0.075		0.075	1.614	1.540	2.203	2.129	1.178	1.104
12	19	2018				0.075	0.075		0.075	1.713	1.639	2.378	2.303	1.230	1.155
13	20	2019				1.288	1.288		1.288	1.819	0.531	2.566	1.279	1.284	-0.004
14	21	2020				1.892	1.892		1.892	1.930	0.039	2.770	0.878	1.340	-0.552
15	22	2021				2.495	2.495		2.495	2.049	-0.446	2.990	0.495	1.398	-1.097
16	23	2022				0.680	0.680		0.680	2.175	1.495	3.227	2.547	1.460	0.780
17	24	2023				0.075	0.075		0.075	2.309	2.234	3.483	3.408	1.523	1.449
18	25	2024				0.075	0.075		0.075	2.451	2.376	3.759	3.684	1.590	1.515
19	26	2025				0.075	0.075		0.075	2.602	2.527	4.057	3.983	1.660	1.585
20	27	2026				0.075	0.075		0.075	2.762	2.687	4.379	4.305	1.732	1.658
21	28	2027				0.075	0.075		0.075	2.932	2.857	4.727	4.652	1.808	1.733
22	29	2028				0.075	0.075		0.075	3.112	3.037	5.102	5.028	1.887	1.813
23	30	2029				0.075	0.075		0.075	3.304	3.229	5.507	5.433	1.970	1.895
24	31	2030				0.075	0.075		0.075	3.507	3.432	5.945	5.870	2.056	1.981
25	32	2031				0.075	0.075		0.075	3.723	3.648	6.417	6.342	2.146	2.071
26	33	2032				0.075	0.075		0.075	3.952	3.877	6.926	6.852	2.240	2.165
27	34	2033				0.075	0.075		0.075	4.195	4.121	7.477	7.402	2.338	2.264
28	35	2034				0.075	0.075		0.075	4.454	4.379	8.071	7.996	2.441	2.366
29	36	2035				0.075	0.075		0.075	4.728	4.653	8.712	8.637	2.547	2.473
30	37	2036				0.075	0.075		0.075	5.019	4.944	9.404	9.329	2.659	2.584
			5.404	0.652	6.056	8.220	14.276	0.908	13.368	74.754	61.386	117.708	104.340	48.313	34.946
						FIRR					6.00%		8.10%		3.76%

Appendix 5.2.10
Financial Analysis for GMDSS
(Interest Rate: Market Rate 6 %, Evaluation Period: 30 years)

Light Dues 22.82% Units : Million USD

period	No	Year	TTL Cost (GMDSS)							Revenue					
			Civil	Consultant	Initial Cost Total	Operating & Maintenance	Grand Total	Funds (Initial Cost) 15%	Grand Total-Funds	GDP: Likeliest Case		GDP: Optimistic Case		GDP: Pessimistic Case	
										Light Dues		Light Dues		Light Dues	
			1	2	3=1+2	4	5=3+4	6=3 x 0.15	7=5-6	8	9=8-7	10	11=10-7	12	13=12-7
	1	2000													
	2	2001													
	3	2002													
	4	2003		0.689	0.689		0.689	0.103	0.586	3.462	2.876	3.614	3.028	3.315	2.729
	5	2004		0.862	0.862		0.862	0.129	0.732	3.755	3.023	4.005	3.272	3.518	2.786
	6	2005	13.784	0.862	14.646		14.646	2.197	12.449	4.073	-8.376	4.438	-8.010	3.734	-8.715
	7	2006	15.507	0.689	16.196		16.196	2.429	13.767	4.418	-9.348	4.920	-8.847	3.963	-9.804
1	8	2007	6.892	0.517	7.409	0.361	7.770	1.111	6.658	4.794	-1.865	5.455	-1.203	4.206	-2.452
2	9	2008				0.361	0.361		0.361	5.202	4.841	6.050	5.689	4.466	4.105
3	10	2009				0.361	0.361		0.361	5.646	5.285	6.711	6.350	4.741	4.380
4	11	2010				0.361	0.361		0.361	6.129	5.768	7.446	7.085	5.034	4.673
5	12	2011				0.361	0.361		0.361	6.505	6.144	8.035	7.674	5.254	4.893
6	13	2012				0.361	0.361		0.361	6.904	6.543	8.672	8.311	5.483	5.123
7	14	2013				0.361	0.361		0.361	7.328	6.968	9.359	8.998	5.723	5.362
8	15	2014				0.361	0.361		0.361	7.779	7.418	10.100	9.739	5.973	5.612
9	16	2015				0.361	0.361		0.361	8.256	7.896	10.901	10.540	6.234	5.873
10	17	2016				0.361	0.361		0.361	8.764	8.403	11.765	11.404	6.507	6.146
11	18	2017				0.361	0.361		0.361	9.302	8.941	12.697	12.336	6.791	6.430
12	19	2018				0.706	0.706		0.706	9.874	9.169	13.704	12.998	7.088	6.383
13	20	2019				0.792	0.792		0.792	10.481	9.689	14.790	13.999	7.398	6.606
14	21	2020				7.684	7.684		7.684	11.125	3.442	15.963	8.280	7.721	0.038
15	22	2021				8.459	8.459		8.459	11.809	3.350	17.229	8.770	8.059	-0.400
16	23	2022				4.065	4.065		4.065	12.535	8.470	18.596	14.531	8.412	4.346
17	24	2023				0.361	0.361		0.361	13.306	12.945	20.071	19.710	8.780	8.419
18	25	2024				0.361	0.361		0.361	14.125	13.764	21.664	21.303	9.164	8.803
19	26	2025				0.361	0.361		0.361	14.994	14.633	23.383	23.022	9.565	9.204
20	27	2026				0.361	0.361		0.361	15.916	15.555	25.239	24.878	9.983	9.622
21	28	2027				0.361	0.361		0.361	16.895	16.534	27.242	26.881	10.420	10.059
22	29	2028				0.361	0.361		0.361	17.935	17.574	29.405	29.044	10.876	10.515
23	30	2029				0.361	0.361		0.361	19.039	18.678	31.739	31.378	11.352	10.991
24	31	2030				0.361	0.361		0.361	20.210	19.849	34.259	33.898	11.849	11.488
25	32	2031				0.361	0.361		0.361	21.454	21.093	36.980	36.619	12.368	12.007
26	33	2032				0.361	0.361		0.361	22.775	22.414	39.917	39.556	12.909	12.549
27	34	2033				0.361	0.361		0.361	24.177	23.817	43.088	42.727	13.475	13.114
28	35	2034				0.361	0.361		0.361	25.666	25.305	46.511	46.150	14.065	13.704
29	36	2035				0.361	0.361		0.361	27.247	26.886	50.206	49.846	14.681	14.320
30	37	2036				0.361	0.361		0.361	28.925	28.564	54.196	53.835	15.324	14.963
			36.183	3.618	39.801	30.727	70.529	5.970	64.559	430.806	366.248	678.351	613.793	278.431	213.872
						FIRR					6.00%		7.90%		4.07%

Appendix 5.2.11

Financial Analysis for Ship Reporting System

(Interest Rate: Market Rate 6 %, Evaluation Period: 30 years)

Light Dues 5.78% Units : Million USD

period	No	Year	TTL Cost (Ship Reporting System)							Revenue					
			Civil	Consultant	Initial Cost Total	Operating & Maintenance	Grand Total	Funds (Initial Cost) 15%	Grand Total-Funds	GDP: Likeliest Case		GDP: Optimistic Case		GDP: Pessimistic Case	
										Light Dues		Light Dues		Light Dues	
			1	2	3=1+2	4	5=3+4	6=3 x 0.15	7=5-6	8	9=8-7	10	11=10-7	12	13=12-7
	1	2000													
	2	2001													
	3	2002													
	4	2003								0.877	0.877	0.916	0.916	0.840	0.840
	5	2004								0.951	0.951	1.015	1.015	0.891	0.891
	6	2005		0.297	0.297		0.297	0.045	0.253	1.032	0.779	1.124	0.872	0.946	0.693
	7	2006	1.982	0.297	2.280		2.280	0.342	1.938	1.119	-0.818	1.247	-0.691	1.004	-0.934
1	8	2007	5.452	0.297	5.749		5.749	0.862	4.887	1.215	-3.672	1.382	-3.504	1.066	-3.821
2	9	2008	2.974	0.149	3.122	0.139	3.261	0.46834	2.793	1.318	-1.474	1.533	-1.260	1.131	-1.661
3	10	2009				0.139	0.139		0.139	1.431	1.292	1.700	1.562	1.201	1.063
4	11	2010				0.139	0.139		0.139	1.553	1.414	1.886	1.748	1.275	1.137
5	12	2011				0.139	0.139		0.139	1.648	1.510	2.036	1.897	1.331	1.193
6	13	2012				0.139	0.139		0.139	1.749	1.611	2.197	2.059	1.389	1.251
7	14	2013				0.139	0.139		0.139	1.857	1.718	2.371	2.233	1.450	1.311
8	15	2014				0.139	0.139		0.139	1.971	1.832	2.559	2.420	1.513	1.375
9	16	2015				0.139	0.139		0.139	2.092	1.953	2.762	2.623	1.580	1.441
10	17	2016				0.139	0.139		0.139	2.220	2.082	2.981	2.842	1.649	1.510
11	18	2017				0.139	0.139		0.139	2.357	2.218	3.217	3.078	1.721	1.582
12	19	2018				0.139	0.139		0.139	2.502	2.363	3.472	3.334	1.796	1.657
13	20	2019				0.139	0.139		0.139	2.656	2.517	3.747	3.609	1.874	1.736
14	21	2020				0.287	0.287		0.287	2.819	2.531	4.045	3.757	1.956	1.669
15	22	2021				1.278	1.278		1.278	2.992	1.714	4.365	3.087	2.042	0.763
16	23	2022				3.013	3.013		3.013	3.176	0.163	4.712	1.699	2.131	-0.882
17	24	2023				1.700	1.700		1.700	3.371	1.672	5.085	3.386	2.224	0.525
18	25	2024				0.139	0.139		0.139	3.579	3.440	5.489	5.350	2.322	2.183
19	26	2025				0.139	0.139		0.139	3.799	3.660	5.924	5.786	2.423	2.285
20	27	2026				0.139	0.139		0.139	4.033	3.894	6.395	6.256	2.529	2.391
21	28	2027				0.139	0.139		0.139	4.281	4.142	6.902	6.764	2.640	2.501
22	29	2028				0.139	0.139		0.139	4.544	4.405	7.450	7.312	2.756	2.617
23	30	2029				0.139	0.139		0.139	4.824	4.685	8.042	7.903	2.876	2.738
24	31	2030				0.139	0.139		0.139	5.121	4.982	8.680	8.542	3.002	2.864
25	32	2031				0.139	0.139		0.139	5.436	5.297	9.370	9.231	3.134	2.995
26	33	2032				0.139	0.139		0.139	5.770	5.632	10.114	9.975	3.271	3.132
27	34	2033				0.139	0.139		0.139	6.126	5.987	10.917	10.778	3.414	3.275
28	35	2034				0.139	0.139		0.139	6.503	6.364	11.784	11.646	3.564	3.425
29	36	2035				0.139	0.139		0.139	6.903	6.765	12.721	12.582	3.720	3.581
30	37	2036				0.139	0.139		0.139	7.329	7.190	13.731	13.593	3.883	3.744
			10.408	1.041	11.448	9.743	21.192	1.717	19.475	109.152	89.677	171.872	152.397	70.545	51.070
						FIRR					6.00%		8.44%		3.65%

Appendix 5.2.12

Financial Analysis for Total Projects

(Interest Rate: Market Rate 6 %, Evaluation Period: 30 years)

Light Dues 49.19% Units : Million USD

period	No	Year	TTL Cost (All Projects)							Revenue					
			Civil	Consultant	Initial Cost Total	Operating & Maintenance	Grand Total	Funds (Initial Cost)	Loan (Initial Cost)	GDP: Likeliest Case		GDP: Optimistic Case		GDP: Pessimistic Case	
								15%	85%	Light Dues		Light Dues		Light Dues	
			1	2	3=1+2	4	5=3+4	6	7=5-6	8	9=8-7	10	11=10-7	12	13=12-7
	1	2000													
	2	2001													
	3	2002													
	4	2003		0.689	0.689		0.689	0.103	0.586	7.464	6.878	7.792	7.206	7.147	6.561
	5	2004	0.952	1.720	2.672		2.672	0.401	2.271	8.095	5.824	8.633	6.362	7.584	5.313
	6	2005	24.238	1.752	25.990		25.990	3.898	22.091	8.780	-13.311	9.568	-12.523	8.049	-14.042
	7	2006	26.767	1.875	28.641		28.641	4.296	24.345	9.525	-14.820	10.607	-13.738	8.543	-15.802
1	8	2007	24.623	1.398	26.021	0.361	26.381	3.903	22.478	10.335	-12.143	11.761	-10.717	9.069	-13.410
2	9	2008	3.539	0.269	3.808	0.604	4.412	0.571	3.841	11.215	7.375	13.043	9.203	9.627	5.787
3	10	2009				0.682	0.682		0.682	12.172	11.490	14.468	13.786	10.221	9.539
4	11	2010				0.643	0.643		0.643	13.213	12.570	16.052	15.409	10.853	10.210
5	12	2011				0.891	0.891		0.891	14.024	13.133	17.323	16.433	11.327	10.436
6	13	2012				1.681	1.681		1.681	14.885	13.204	18.695	17.014	11.822	10.141
7	14	2013				0.682	0.682		0.682	15.799	15.117	20.177	19.494	12.338	11.656
8	15	2014				0.670	0.670		0.670	16.770	16.100	21.775	21.105	12.877	12.208
9	16	2015				1.281	1.281		1.281	17.800	16.519	23.501	22.220	13.440	12.160
10	17	2016				0.643	0.643		0.643	18.894	18.251	25.363	24.721	14.028	13.385
11	18	2017				4.750	4.750		4.750	20.055	15.305	27.374	22.624	14.641	9.891
12	19	2018				0.987	0.987		0.987	21.287	20.300	29.544	28.557	15.281	14.294
13	20	2019				2.532	2.532		2.532	22.596	20.063	31.887	29.354	15.949	13.417
14	21	2020				9.931	9.931		9.931	23.985	14.054	34.415	24.484	16.647	6.716
15	22	2021				12.744	12.744		12.744	25.460	12.715	37.145	24.400	17.375	4.630
16	23	2022				13.683	13.683		13.683	27.025	13.342	40.091	26.408	18.135	4.452
17	24	2023				3.152	3.152		3.152	28.687	25.535	43.272	40.120	18.928	15.776
18	25	2024				0.643	0.643		0.643	30.451	29.809	46.705	46.063	19.756	19.113
19	26	2025				0.891	0.891		0.891	32.324	31.434	50.411	49.520	20.620	19.730
20	27	2026				0.643	0.643		0.643	34.313	33.671	54.412	53.770	21.523	20.880
21	28	2027				8.593	8.593		8.593	36.424	27.831	58.731	50.138	22.465	13.872
22	29	2028				0.626	0.626		0.626	38.666	38.040	63.393	62.767	23.448	22.822
23	30	2029				0.891	0.891		0.891	41.045	40.154	68.426	67.536	24.474	23.583
24	31	2030				0.643	0.643		0.643	43.571	42.929	73.860	73.217	25.546	24.903
25	32	2031				0.905	0.905		0.905	46.253	45.349	79.725	78.820	26.664	25.759
26	33	2032				1.697	1.697		1.697	49.101	47.403	86.057	84.360	27.831	26.134
27	34	2033				0.890	0.890		0.890	52.124	51.234	92.893	92.003	29.050	28.160
28	35	2034				0.643	0.643		0.643	55.334	54.691	100.273	99.630	30.322	29.680
29	36	2035				0.939	0.939		0.939	58.741	57.802	108.240	107.301	31.651	30.711
30	37	2036				0.643	0.643		0.643	62.359	61.717	116.841	116.199	33.037	32.394
			80.118	7.703	87.821	74.561	162.382	13.173	149.209	928.774	779.565	1,462.455	1,313.246	600.267	451.058
									FIRR		6.00%		8.01%		3.96%

Appendix 6.2.1.

Maintenance Budgeting for Coastal Radio Stations
Directorate General of Sea Communication

Unit:Thousand Rupiah

No	Unit of Navigation	Fiscal Year / Maintenance Budgeting						
		1997	1998	1999	2000	2001		2002
						Running	Supllement	
1	Sabang	34,867	41,125	41,125	30,844	29,020		31,678
2	Sibolga	11,795	18,500	18,500	13,875	12,357		65,030
3	Belawan	89,568	52,000	52,000	39,000	39,150		65,016
4	Teluk Bayur	28,196	32,125	32,125	24,094	23,295		58,019
5	Dumai	20,568	49,000	49,000	36,750	33,291		73,270
6	Palembang	50,250	61,500	61,500	46,125	43,400		72,174
7	Tg. Pinang	45,090	37,500	37,500	28,125	25,276		50,913
8	Tg.Priok	160,216	116,072	116,072	87,054	79,844		327,637
9	Cilacap	12,184	17,125	17,125	12,844	13,148	130,200	94,802
10	Semarang	15,250	35,125	35,125	26,344	25,024		28,624
11	Surabaya	101,868	55,000	55,000	41,250	37,835		72,629
12	Benoa	65,676	37,000	37,000	27,750	25,050		97,200
13	Pontianak	18,000	15,500	15,500	11,625	10,508	95,097	28,762
14	Banjarumasin	12,895	41,125	41,125	30,844	29,272		99,333
15	Samarinda	52,589	35,625	35,625	26,719	25,990		56,905
16	Tarakan	12,000	15,500	15,500	11,625	10,522	43,771	14,850
17	Bitung	58,024	82,500	82,500	61,875	57,158		221,362
18	Kendari	30,696	28,000	28,000	21,000	19,016	89,685	32,891
19	Uj.Pandang	22,422	49,000	49,000	36,750	35,688		34,763
20	Kupang	50,535	47,625	47,625	35,719	33,423		135,945
21	Ambon	107,220	70,500	70,500	52,875	49,072		68,012
22	Sorong	10,452	41,625	41,625	31,219	29,560		66,400
23	Jayapura	65,622	34,000	34,000	25,500	25,431		10,497
24	Merauke	10,784	12,500	12,500	11,123	10,420		12,124
25	BTKP	497,040	20,000	20,000	13,335	11,827		17,010
26	Dit. Navigasi						350,000	4,000,000
	Total	1,583,807	1,045,572	1,045,572	784,264	734,577	708,753	5,835,846

Note : BTKP = Maritime Safety Technological Center
Source: DGSC

Appendix 8.2. Ship Handling Simulation Study at Sunda Strait

8.2.1. Purpose

This simulation study utilizing the real time ship handling simulator was implemented to examine the effectiveness of initial plan, such as establishing of appropriate ship's routing system, of the Maritime Traffic Safety System in the target year of 2007, 2020.

In this section, TSS shall be supposed as initial plan and examined. The other methods shall be also examined if necessary.

The Results obtained from this study shall be reflected to revision of initial plan and the most realistic ship's routing system in the area shall be established.

8.2.2. 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. Abstract conception of the real time ship handling simulator is shown in **Figure 8.2.1.** Contribution of ship handling simulator is shown in **Figure 8.2.2**.

Figure 8.2.1. Abstract Conception of the Real Time Ship Handling Simulator

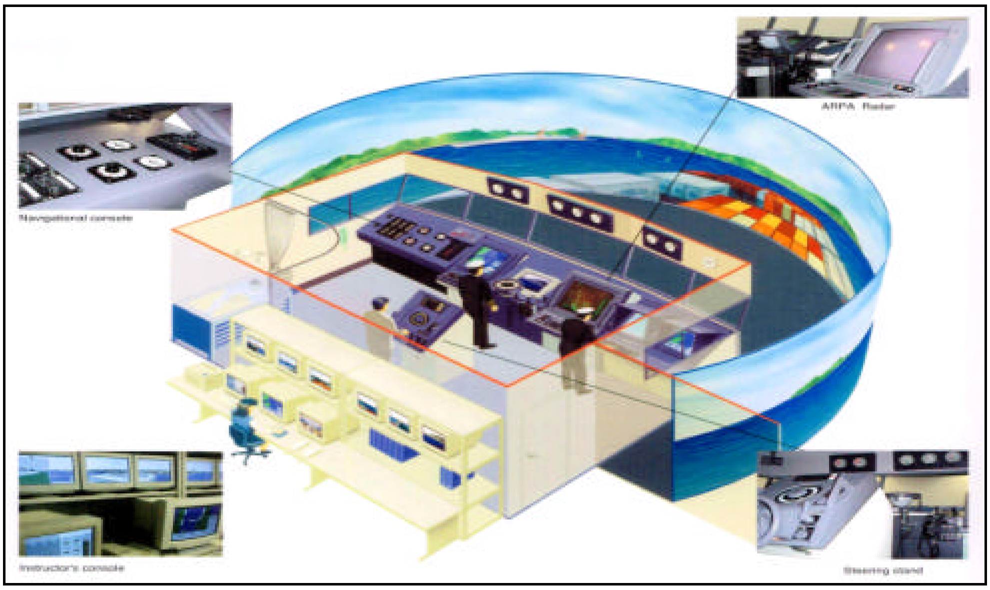
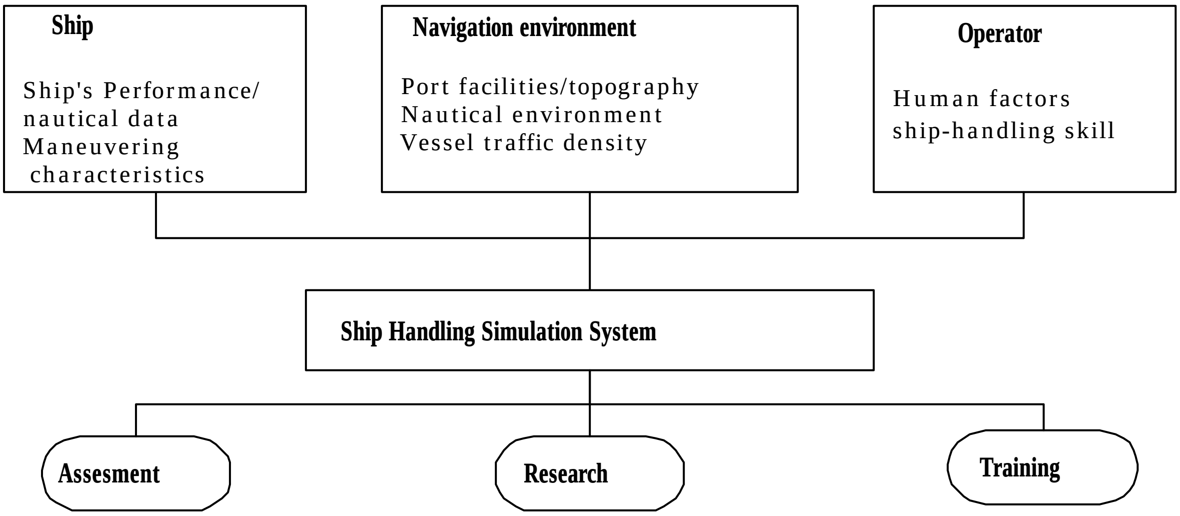


Figure 8.2.2. Contribution of Ship Handling Simulator

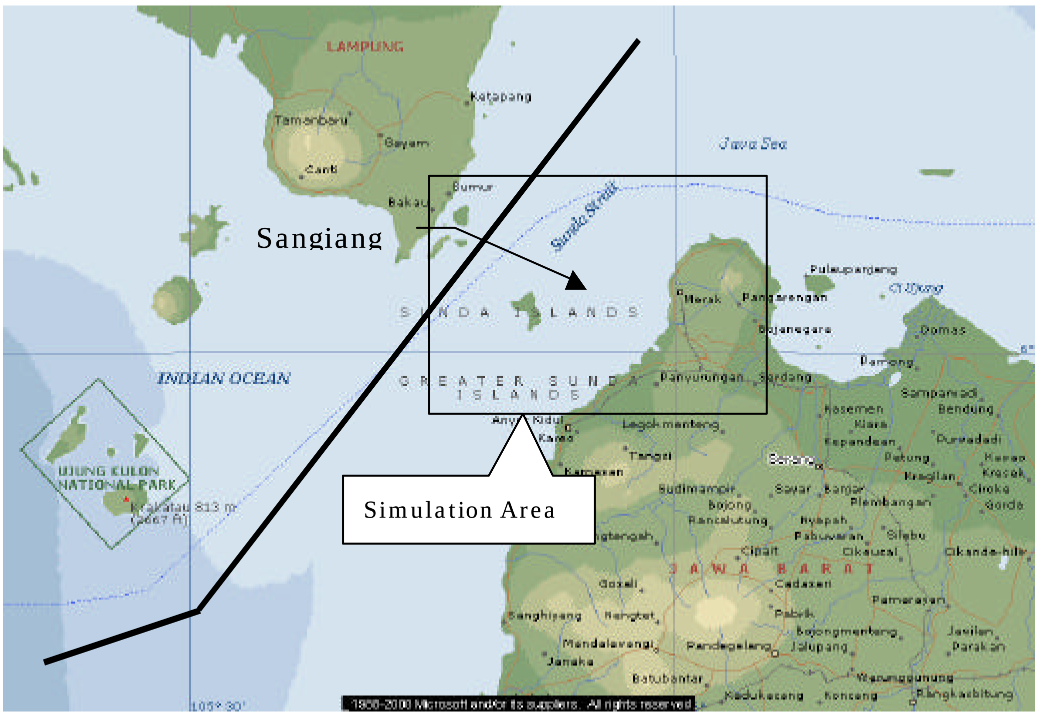


8.2.3. Setting up Conditions

(1) Simulation Area

The simulation area shall be set up in Sunda Strait shown in **Figure 8.2.3.** The simulation study shall be implemented in east and west side of Sangiang Island.

Figure 8.2.3. Simulation Area



(2) Model Vessel

Model vessel, which is supposed to be largest in this area, shall be VLCC of 280,000DWT class. Principal particulars of model vessel are shown in **Table 8.2.1.**

Table 8.2.1. Principal Particular of Model Vessel

Item	280,000 DWT
LOA (m)	330.0
Lpp. (m)	316.6
Breath (m)	60.0
Draft (m)	Southbound: 10.5m Northbound: 20.5m

(3) Traffic Condition

The Traffic condition at the area of this Study is based on situations at present, in 2007 and 2020.

The present Traffic condition refers the Maximum Passing Vessels Volume from the Survey of Actual Maritime Traffic in Oct. 2001.

Moreover, the traffic volumes in 2007 and 2020 were obtained as 1.6 times in 2007 and 3.7 time in 2020 comparing to the present volume referred to the Future Interisland and International Calling Vessels Volume of the Final Report.

(4) Natural Conditions

Natural condition is shown in **Table 8.2.2.**

Table 8.2.2. Natural Conditions

Items	Conditions
Wind direction/velocity	ESE 5m/sec
Tide	South 1.25 Kts/h
Visibility	10 miles
Day/Night	Daytime

(5) Simulation Scenario – Condition Matrices of Ship Handling Simulator

For implementing the ship-handling simulation, we discussed simulation scenarios with senior captains.

Based on this discussion, we divided two stages which means Stage-1 is without the premises of TSS and Stage-2 is with the premises of TSS.

The simulation scenario consists of 20 cases that are combinations of the traffic condition of North/Southbound.

The simulation scenario is shown in **Table 8.2.3.**

Table 8.2.3. Simulation Scenario

Stage	Traffic Condition	TSS	Routes		Test Cases
			Eastside Channel of Sangiang Island	Westside Channel of Sangiang Island	
Stage- 1	Present Condition	—	North / South bound	North / South bound	4 cases
Stage- 2	2007	—	North / South bound	North / South bound	4 cases
Stage- 2	2020	N/A	North / South bound	North / South bound	4 cases
Stage- 2	2007	Case I	North / South bound	—	2 cases
Stage- 2	2020	Case I	North / South bound	—	2 cases
Stage- 2	2007	Case II	North bound	South bound	2 cases
Stage- 2	2020	Case II	North bound	South bound	2 cases
Total					20 cases

TSS shall be established for the simulation study in accordance with **Table 8.2.4.**

Table 8.2.4. Establishment of TSS

Case	Establishment of TSS
Case I	Southbound and Northbound TSS in Eastside channel of Sangiang Island
Case II	Northbound TSS in Eastside channel of Sangiang Island, Southbound TSS in Westside channel of Sangiang Island

Establishment of TSS (Case I and Case II) are shown in **Figure 8.2.4** and **Figure 8.2.5** respectively .

Figure 8.2.4. Establishment of TSS (Case I)

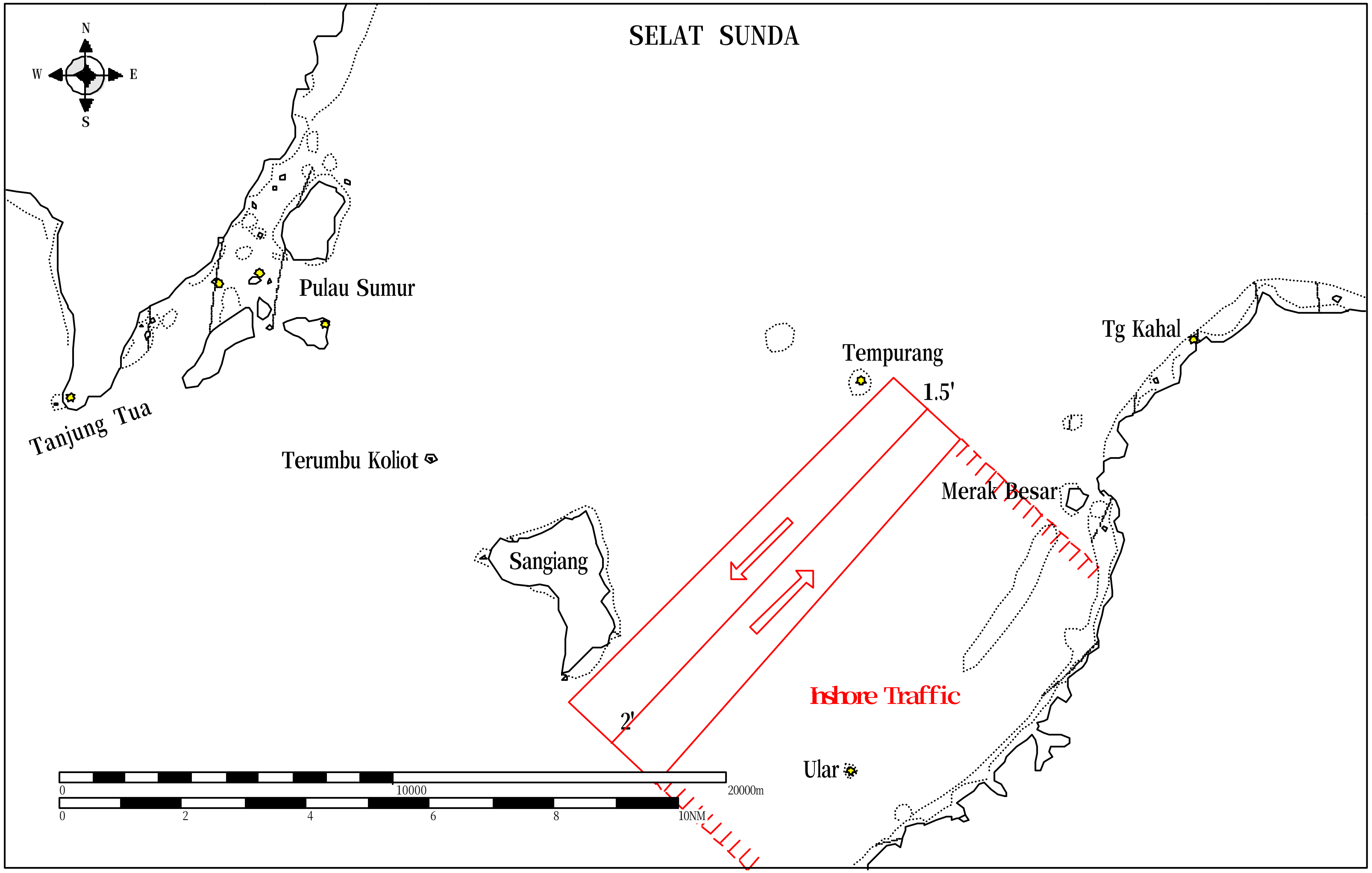
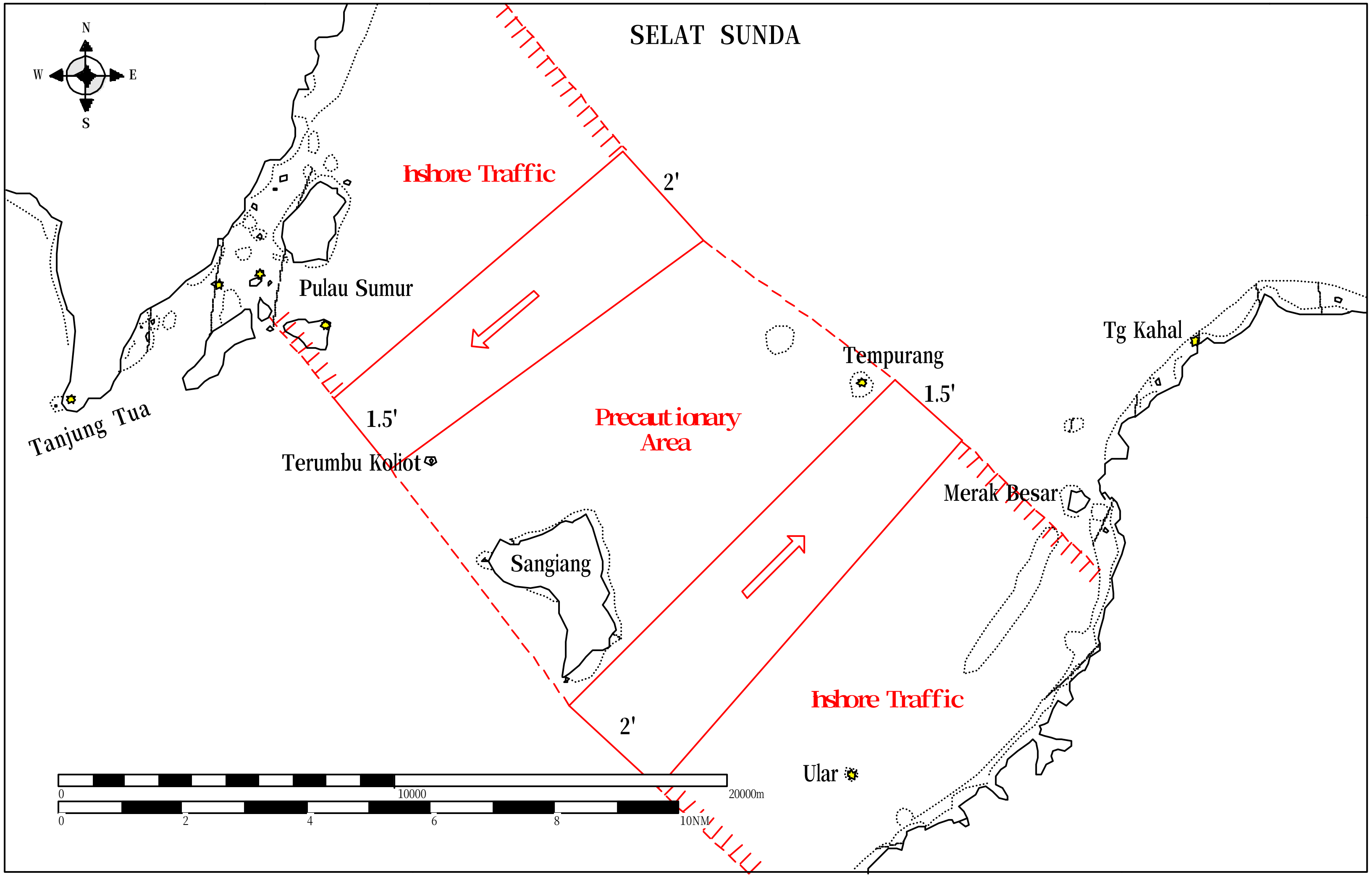


Figure 8.2.5. Establishment of TSS (Case II)



8.2.4. Rating by ship handler

Rating by the ship handler participated in this simulation who is to be experienced captain and rating by the observation of the other participants who are experienced captains are done through questionnaire.

8.2.5. Rating by Blocking Coefficients of Avoiding Action

Blocking coefficients is a numerical factor that expresses the level of restriction (blocking) of collision-avoiding action (combination of alterations of course and speed = Avoiding Action) of own vessel, and it is an index to evaluate the safety of navigation in certain water area quantitatively.

Blocking coefficients is expressed between 0 and 1.0, then “0” represents that there are no other vessels and no risk of collision (opened area). On other hand, when collision-avoiding action is limited to 50% due to existence of obstructions such like other vessels, blocking coefficients is expressed as 0.5. Blocking coefficients from viewpoint of own vessel shall be calculated from simulation results.

Each pattern of scenario shall be 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.
By these way, comprehensive study for vessel traffic safety system including establishment of adequate TSS in that water area shall be implemented with confirmation of the effectiveness of TSS and pointing out existing problems.

8.2.6. Record of Ship Handling Simulation Study (Stage-1)

Ship trajectories are to be recorded as time series for each run.
Trajectories of maneuver are shown in **Figure 8.2.6, Figure 8.2.7, Figure 8.2.8** and **Figure 8.2.9.**

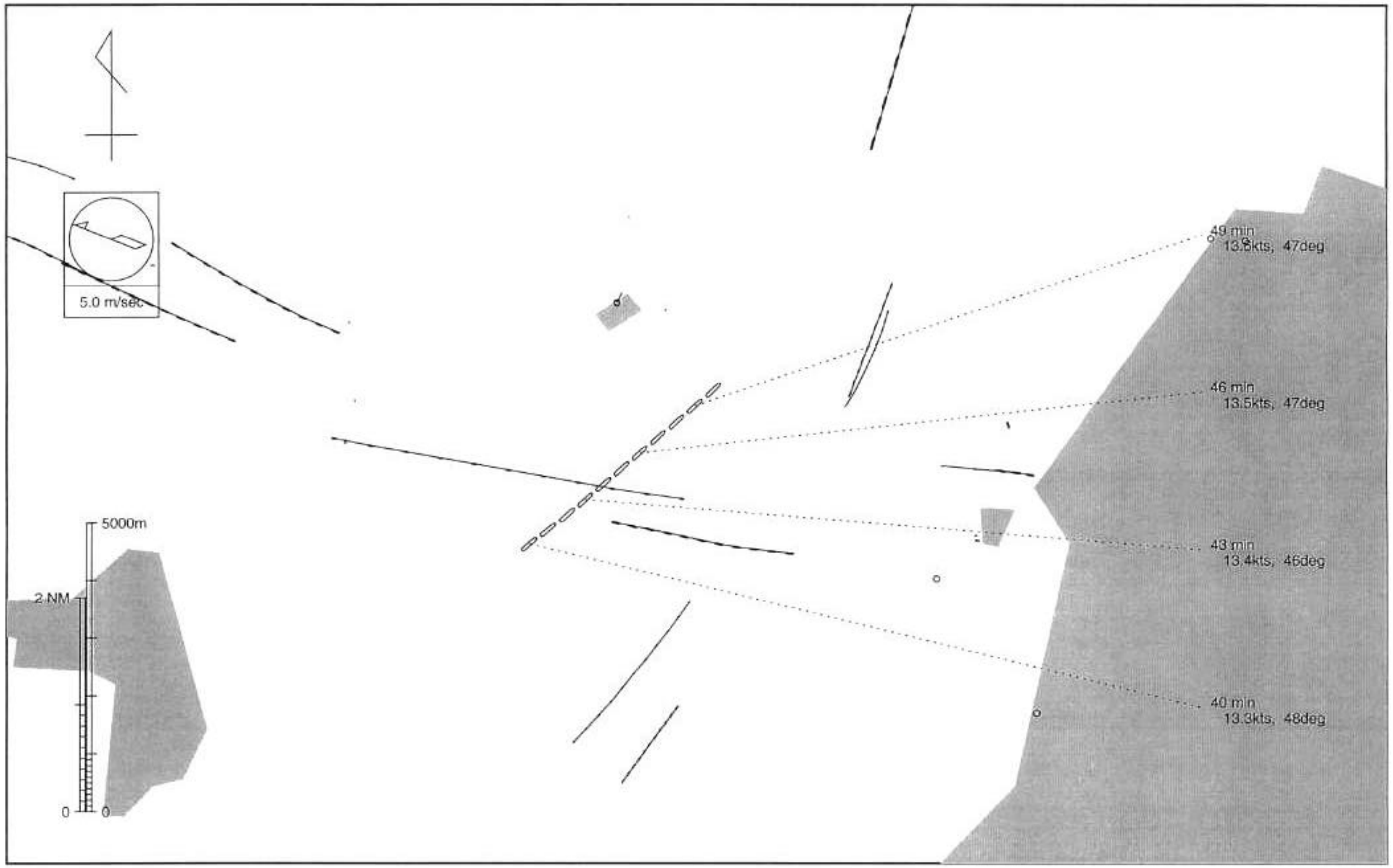
(1) Simulation Scenario of Stage-1

Simulation scenario of stage-1 is shown in **Table 8.2.5**

Table 8.2.5. Simulation Scenario of Stage-1

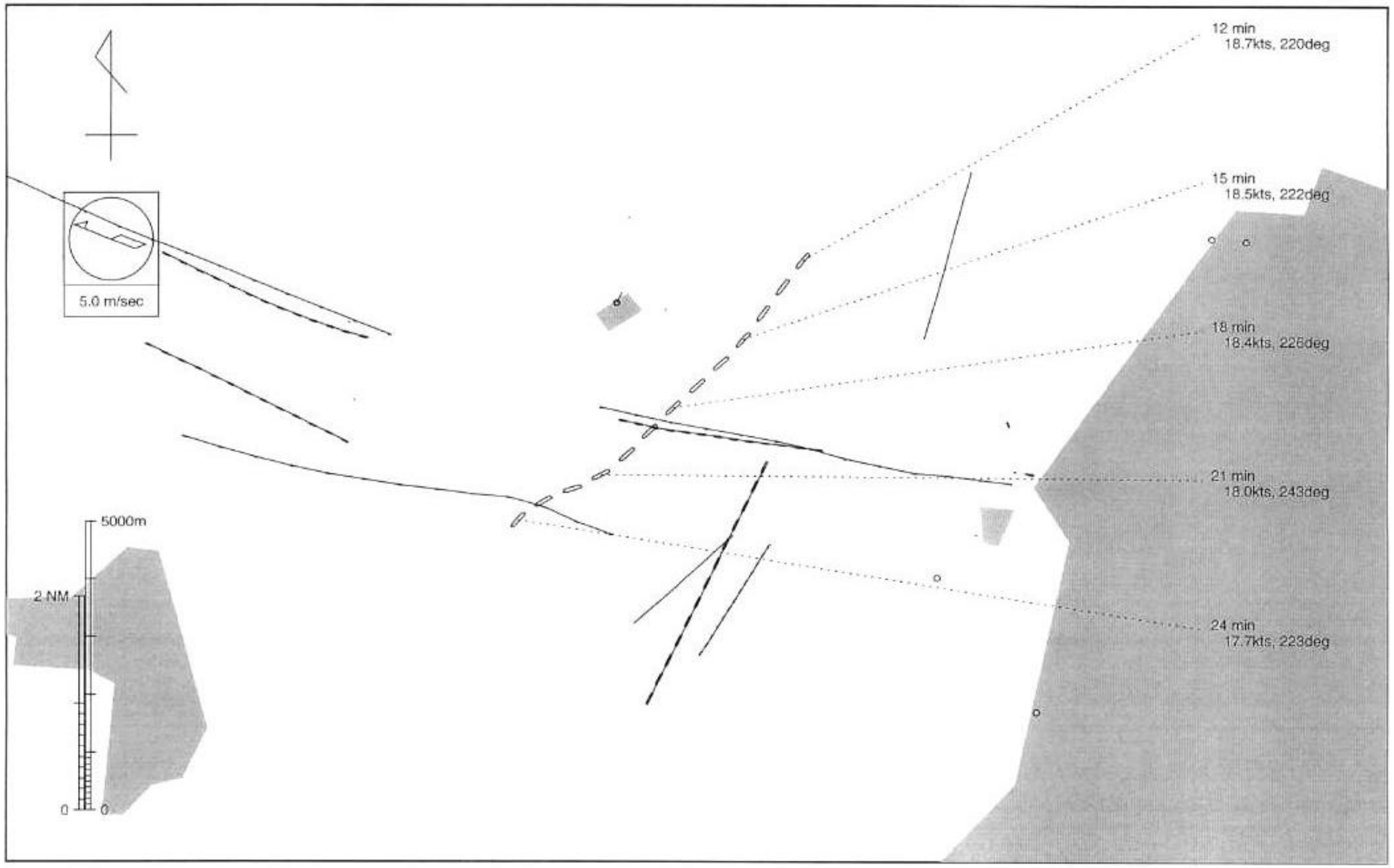
Code	Year	Draft	Channel	Bound	Tidal Current	Wind	TSS
01	2001	20.5m	East	North	South 1.25 knots	ESE 5m/sec	Nil
02	2001	10.5m	East	South	South 1.25 knots	ESE 5m/sec	Nil
03	2001	20.5m	West	North	South 1.25 knots	ESE 5m/sec	Nil
04	2001	10.5m	West	South	South 1.25 knots	ESE 5m/sec	Nil

Figure 8.2.6. TRAJECTORY OF MANEUVER (CODE 01)



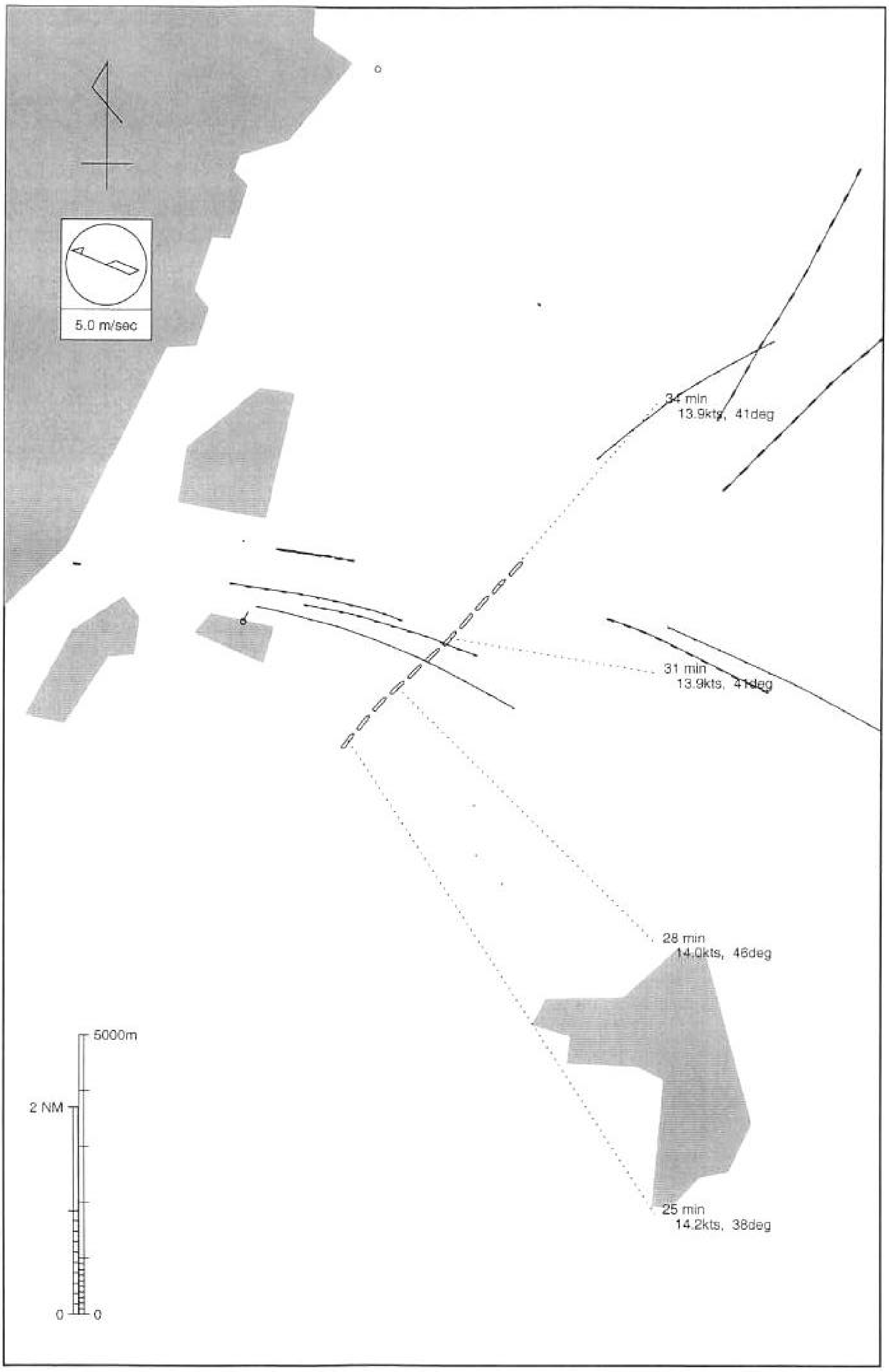
Code	Year	Draft	Channel	Bound	Tidal Current	Wind	TSS
Code 01	2001	20.5m	East	North	South 1.25 knots	ESE 5m/sec	Nil

Figure 8.2.7. TRAJECTORY OF MANEUVER (CODE 02)



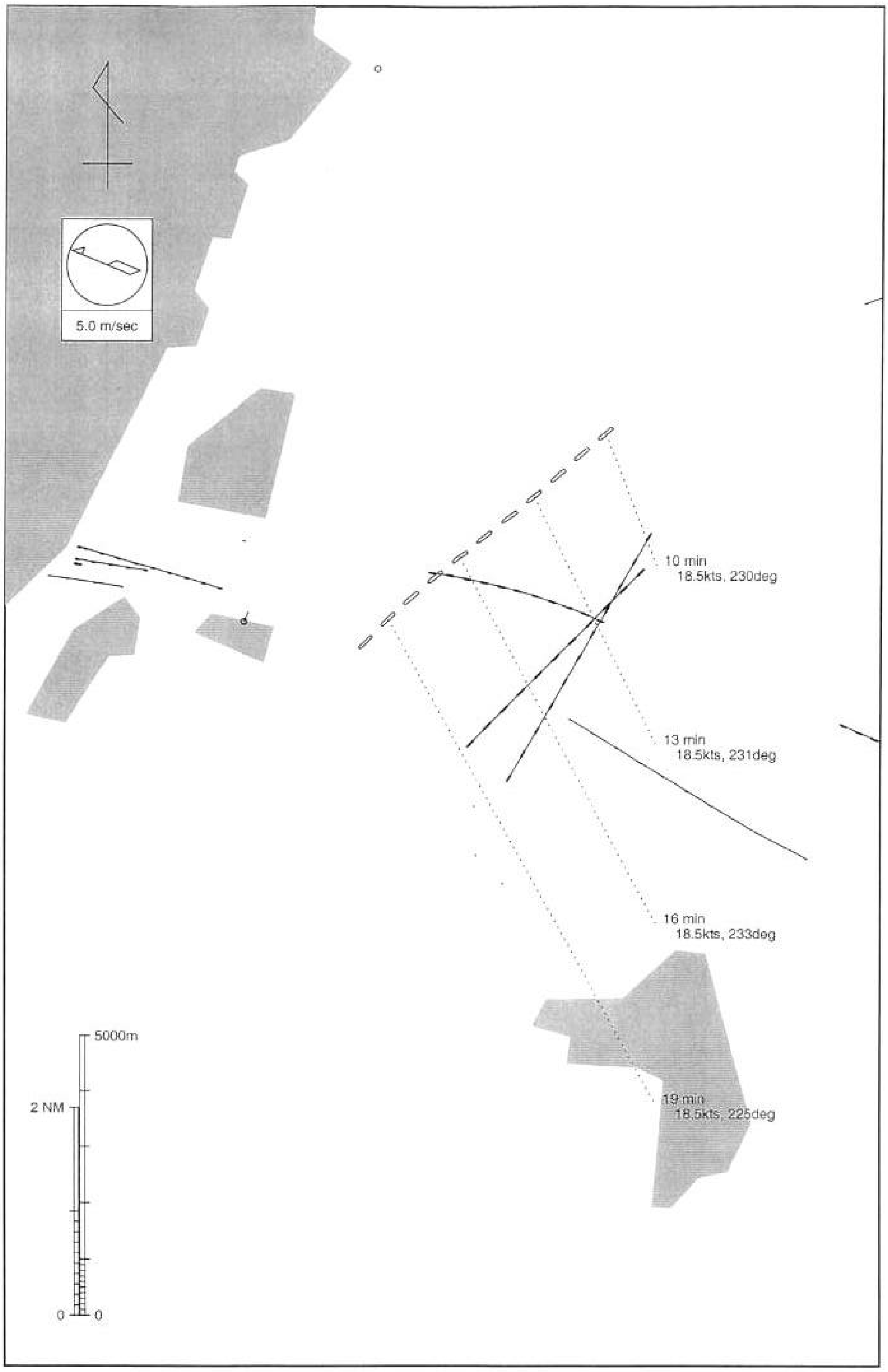
Code	Year	Draft	Channel	Bound	Tidal Current	Wind	TSS
Code 02	2001	10.5m	East	South	South 1.25 knots	ESE 5m/sec	Nil

Figure 8.2.8. TRAJECTORY OF MANEUVER (CODE 03)



Code	Year	Draft	Channel	Bound	Tidal Current	Wind	TSS
Code 03	2001	20.5m	West	North	South 1.25 knots	ESE 5m/sec	Nil

Figure 8.2.9. TRAJECTORY OF MANEUVER (CODE 04)



Code	Year	Draft	Channel	Bound	Tidal Current	Wind	TSS
Code 04	2001	10.5m	West	South	South 1.25 knots	ESE 5m/sec	Nil

(2) Rating by Captains of Stage-1

Rating by the captain's observation on the scene had implemented through questionnaire. The questionnaire is shown in **Figure 8.2.10.**

Figure 8.2.10. Questionnaire

QUESTIONNAIRE

NAME Capt. ______________________ COMPANY ______

Please fill up your opinion I accordance with the undermentioned query.

1. How do you think if we plan to pass for the VLCC (280,000 D/W) at the SELAT SUNDA without economical matters.

   a. no risk b. even c. low risk d. high risk

2. Do you feel what kind of risk ?

   a. collision b. aground c. other ______________________

3. Do you have any Idea in order to decrease the above risks.

   a. TSS b. VTIS c. Daylight Passing d. other _______

4. If we plan to set the TSS, where is the best location ?

   a. both side of SANGIANG island

   b. Between SANGIAN island and west coast of JAWA

   c. Both side of TERUMBU KOLIOT

5. If you mind many fishing boats at South of the SANGIANG island, how do you feel for passing at 4. (b) with safety ?

The summary of questionnaires

Query 1. How do you think if we plan to pass for the VLCC (280,000 D/W) at the SELAT SUNDA without economical matters.

Answer 1.

No risk	Even	low risk	high risk
0	3	6	1

Query 2. Do you feel what kind of risk ?

Answer 2.

collision	Aground	other
9	5	0

Query 3. Do you have any Idea in order to decrease the above risks.

Answer 3.

TSS	VTIS	Daylight Passing	other
9	0	2	1

Query 4. If we plan to set the TSS, where is the best location?

Answer 4.

Both side of SANGIANG island	Between SANGIAN island and west coast of JAWA	Both side of TERUMBU KOLIOT
9	0	1

Query 5. If you mind many fishing boats at South of the SANGIANG island, How do you feel for passing at 4. (b) with safety ?

Answer 5

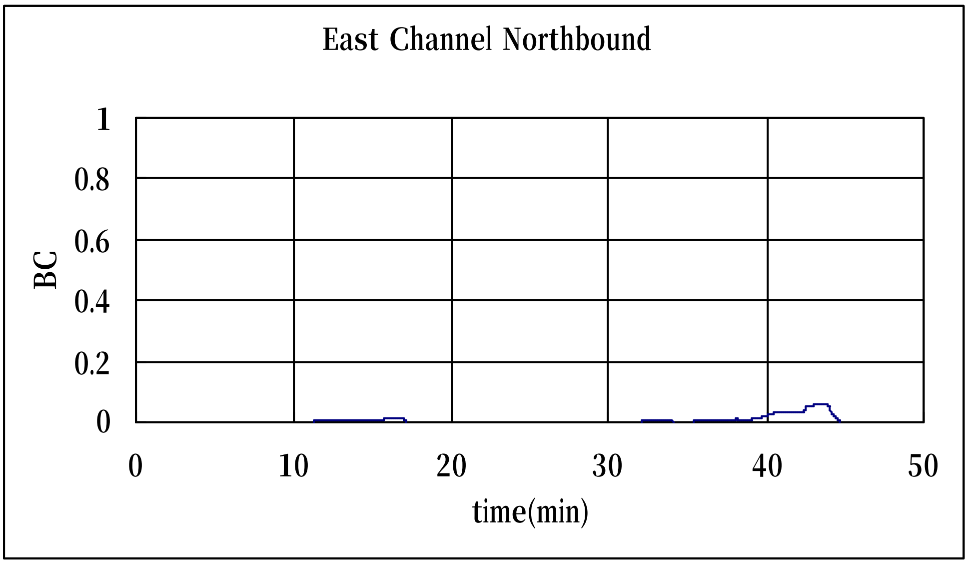
- Difficult 2
- If meeting situation occurs and many fishing boats at this area, serious risk (collision and grounding) shall appear.
- Especially for northbound vessels, increase risk of grounding due to avoid fishing boats. Recommend TSS at both sides of Sangiang islands.
- Passing with care. In case of squall and night time, S/B eng. and increase look out shall be considered.
- If fishing boats stop or move slowly, feel not so danger.
- I will change her co. to pass west side of Sangiang Island when northbound.
- Changing Route. Particularly night time, in case of enough water, carefully proceed with slow speed.
- Reduce speed and proceed with care.
- For VLCC, it may be sometimes dangerous.

(3) Rating by Blocking Coefficients of Avoiding Action of Stage-1

a) East channel northbound (Code 01)

Rating by blocking coefficients is shown in **Figure 8.2.11.**

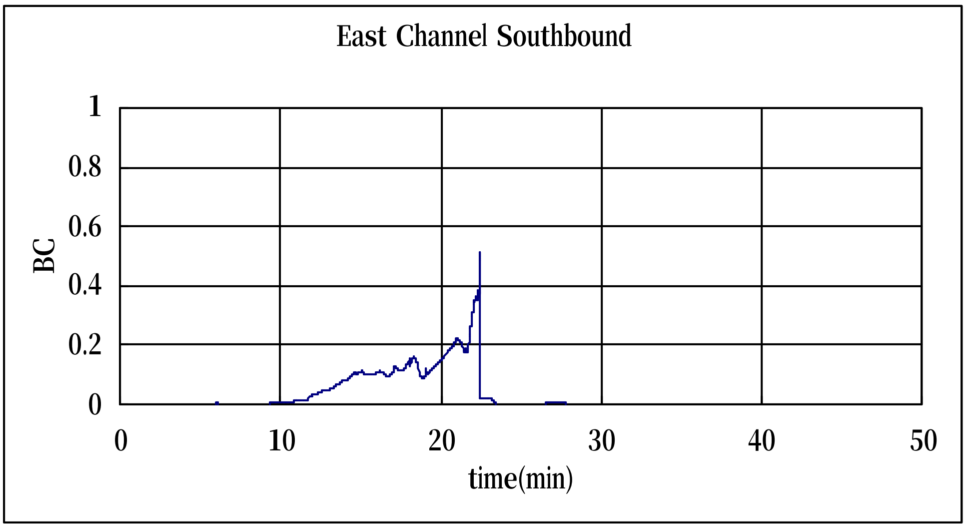
Figure 8.2.11. East Channel Northbound



b) East channel southbound (Code 02)

Rating by blocking coefficients is shown in **Figure8.2.12.**

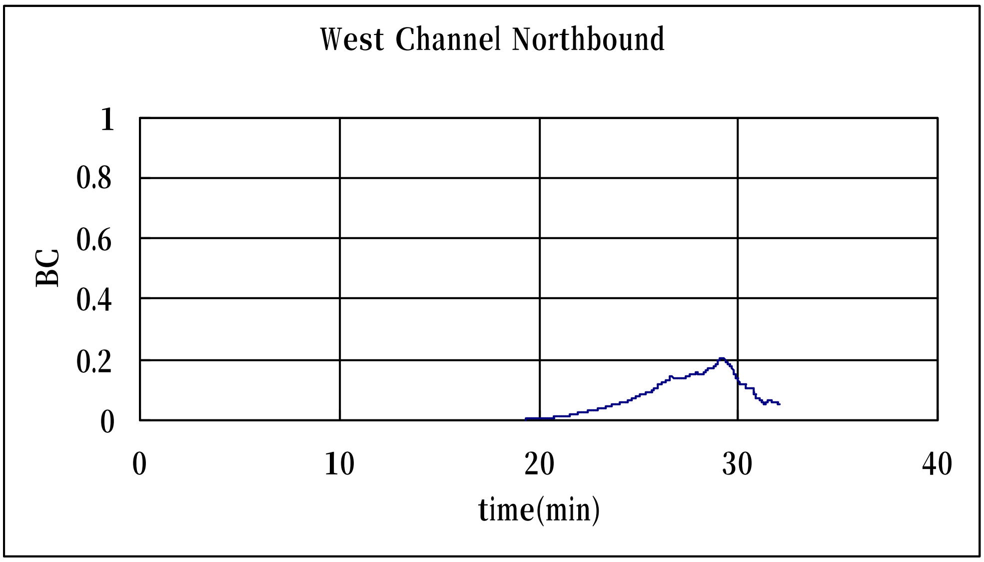
Figure 8.2.12. East Channel Southbound



c) West channel northbound (Code 03)

Rating by blocking coefficients is shown in **Figure 8.2.13.**

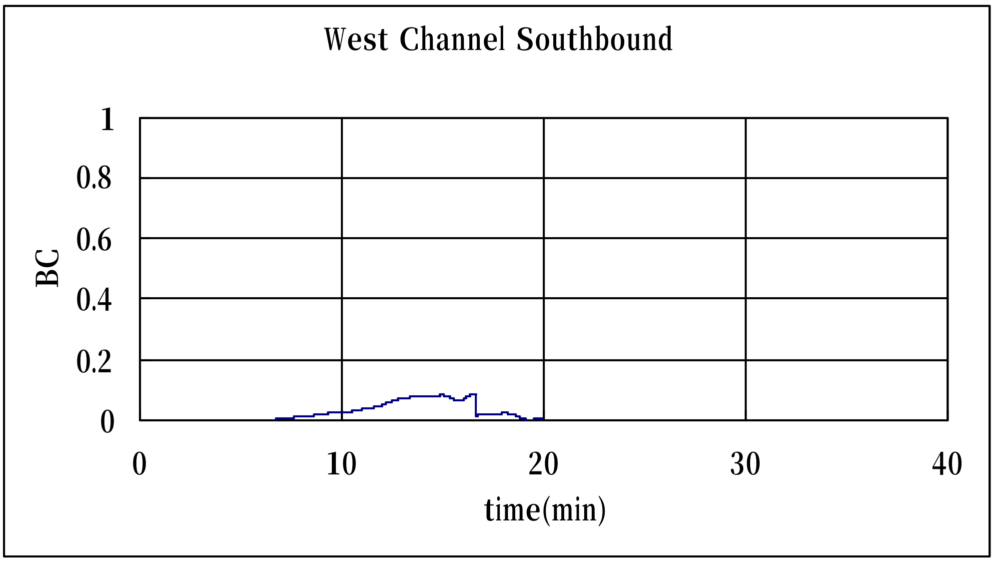
Figure 8.2.13. West Channel Northbound



d) West channel southbound (Code 04)

Rating by blocking coefficients is shown in **Figure8.2.14.**

Figure 8.2.14. West Channel Southbound



(4) Discussion of Stage-1

① Rating by captains

If VLCC (280,000DWT) will pass this strait, the summary of captain's opinions are as follows.

a. Regarding risk, they think there is low or even risk of collision or aground.

In order to decrease such risks, they think TSS or daylight passing is necessary.

b. For the location of TSS to be settled, almost opinions are at the both side of SANGIANG island except one opinion at the both side of TERUMBU KOLIOT.

c. Regarding their opinions on presence of many fishing boats between SANGIANG island and west coast of JAWA when they pass this area, many captains feel danger and necessity to take proper countermeasures such as reducing speed, increasing lookout capability and changing course to west channel, especially in night time or squall.

② Rating by blocking coefficients of avoiding action

Regarding rating by blocking coefficients of avoiding action, the results show max of 0.2 except in case of east channel southbound. It means almost no problem. But in the case of east channel southbound, it shows max of 0.5. This figure is relatively high. In general speaking, if this figure exceeds 0.6, a captain on the bridge will meet a burdensome situation. This situation had happened at the crossing situation against crossing ferry boat. Figure 0.5 means that avoiding action limit to 50%.

③ Overall rating

So far as the results of this real time simulation, there are not available so major problem. However the special attention should be paid in the case of crossing situation with ferry boat, especially night time and restricted visibility.

Next simulation shall be implemented under such a forecasted traffic conditions in 2007 and 2020.

8.2.7. Record of Ship Handling Simulation Study (Stage-2)

Ship trajectories and following items are to be recorded as time series for each run.

① Trajectory of maneuver
② Steering
③ Engine motion
④ Ship speed
⑤ Drift angle
⑥ Turning rate

Trajectories of maneuver are shown in **Figure 8.2.17, Figure 8.2.19, Figure 8.2.21, Figure 8.2.23, Figure 8.2.25, Figure 8.2.27, Figure 8.2.29, Figure 8.2.31, Figure 8.2.33, Figure 8.2.35, Figure 8.2.37, Figure 8.2.39, Figure 8.2.41, Figure 8.2.43, Figure 8.2.45** and **Figure 8.2.47.**
Time history of maneuvering are shown in **Figure 8.2.18, Figure 8.2.20, Figure 8.2.22, Figure 8.2.24, Figure 8.2.26, Figure 8.2.28, Figure 8.2.30, Figure 8.2.32, Figure 8.2.34, Figure 8.2.36, Figure 8.2.38, Figure 8.2.40, Figure 8.2.42, Figure 8.2.44, Figure 8.2.46** and **Figure 8.2.48.**

Remark: Track of other vessels
On the simulation scenario of stage-2, the following markings were put in order to make the tracks of other vessels easy to be differentiated:

- Moving vessel: three-figure numbers at the start point and marking every 3 minutes to follow the track after the start point same as the case of VLCC.
- No moving vessel that means fishing boat engaged in fishing and etc.: four-figure number.

(1) Simulation Scenario of Stage-2
Simulation scenarios of stage-2 are shown in **Table 8.2.6.**

Table 8.2.7. Simulation Scenario of Stage-2

Code	Year	Draft	Channel	Bound	Tidal Current	Wind	TSS
05	2007	20.5m	East	North	South 1.25 knots	ESE 5m/sec	Nil
06	2007	10.5m	East	South	South 1.25 knots	ESE 5m/sec	Nil
07	2007	20.5m	West	North	South 1.25 knots	ESE 5m/sec	Nil
08	2007	10.5m	West	South	South 1.25 knots	ESE 5m/sec	Nil
09	2007	20.5m	East	North	South 1.25 knots	ESE 5m/sec	Case I
10	2007	10.5m	East	South	South 1.25 knots	ESE 5m/sec	Case I
11	2007	20.5m	East	North	South 1.25 knots	ESE 5m/sec	Case II
12	2007	10.5m	West	South	South 1.25 knots	ESE 5m/sec	Case II
13	2020	20.5m	East	North	South 1.25 knots	ESE 5m/sec	Nil
14	2020	10.5m	East	South	South 1.25 knots	ESE 5m/sec	Nil
15	2020	20.5m	West	North	South 1.25 knots	ESE 5m/sec	Nil
16	2020	10.5m	West	South	South 1.25 knots	ESE 5m/sec	Nil
17	2020	20.5m	East	North	South 1.25 knots	ESE 5m/sec	Case I
18	2020	10.5m	East	South	South 1.25 knots	ESE 5m/sec	Case I
19	2020	20.5m	East	North	South 1.25 knots	ESE 5m/sec	Case II
20	2020	10.5m	West	South	South 1.25 knots	ESE 5m/sec	Case II

(2) The photographs of Simulator Experiments

The photographs of simulator experiments are shown in **Figure 8.2.15**, **Figure 8.2.16**.

Figure 8.2.15. View from South of Sangiang Island (1)

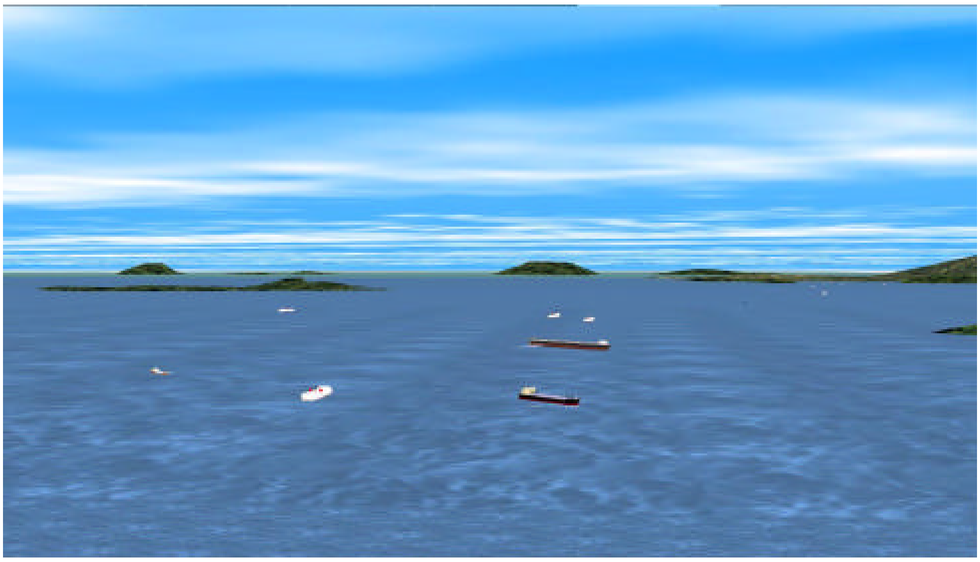


Figure 8.2.16. View from South of Sangiang Island (2)

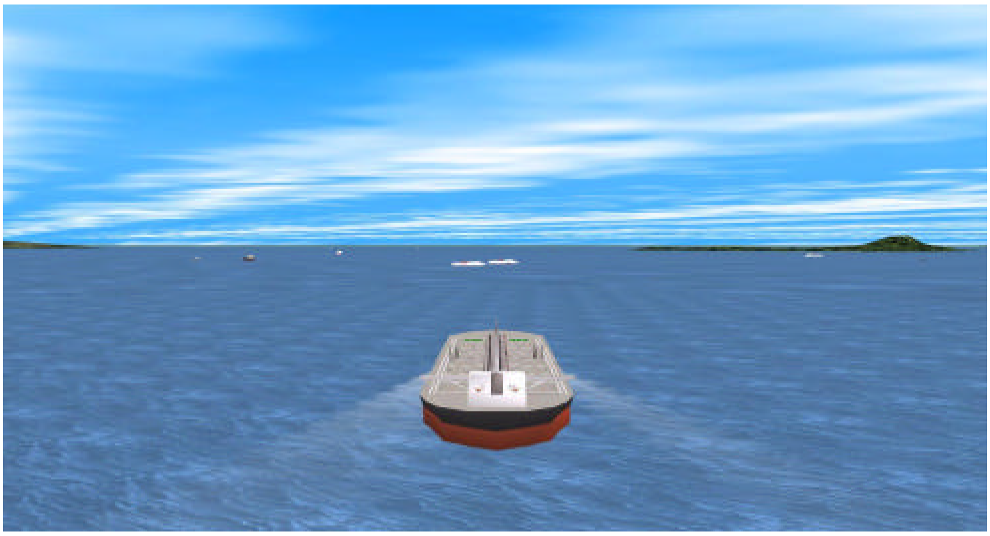
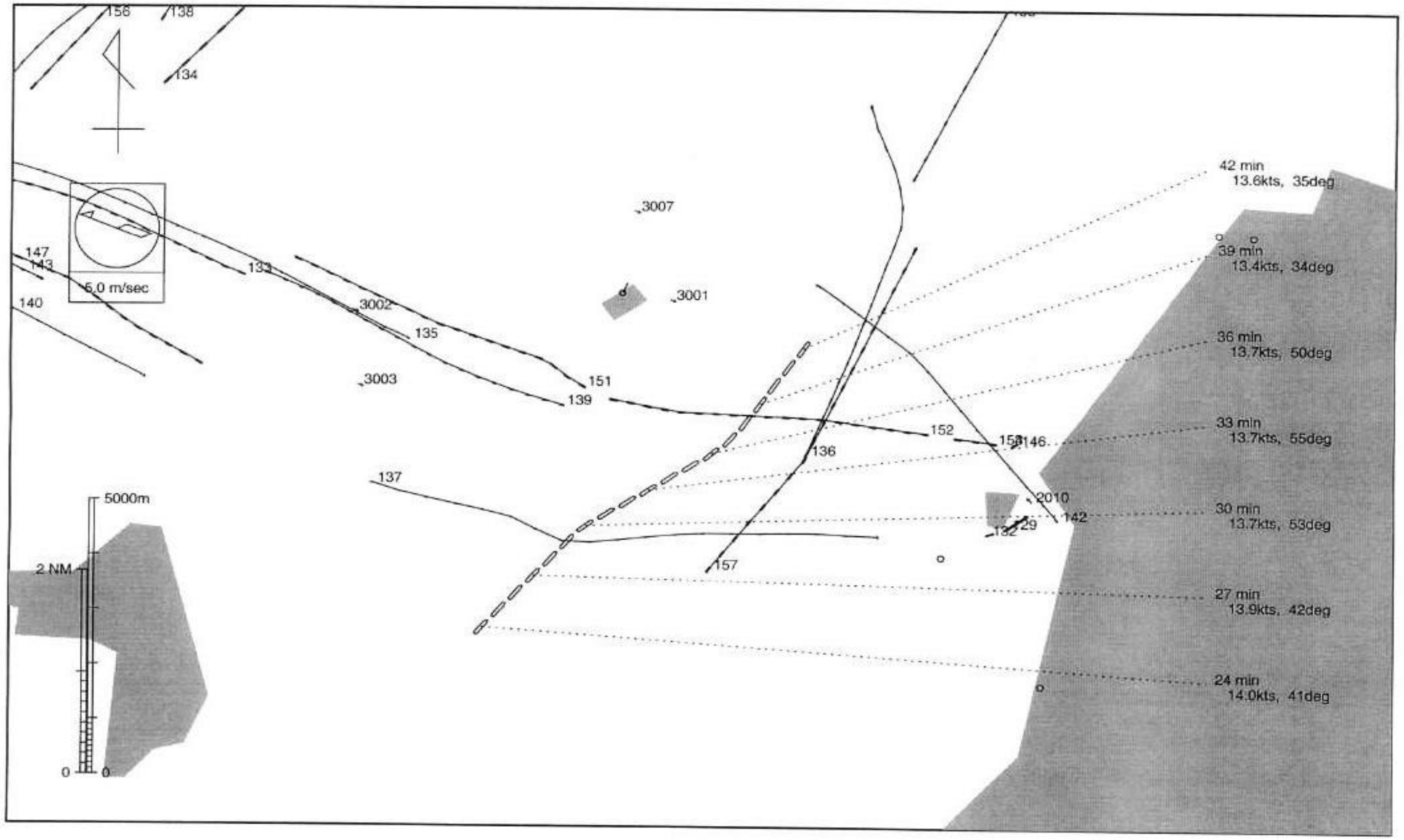
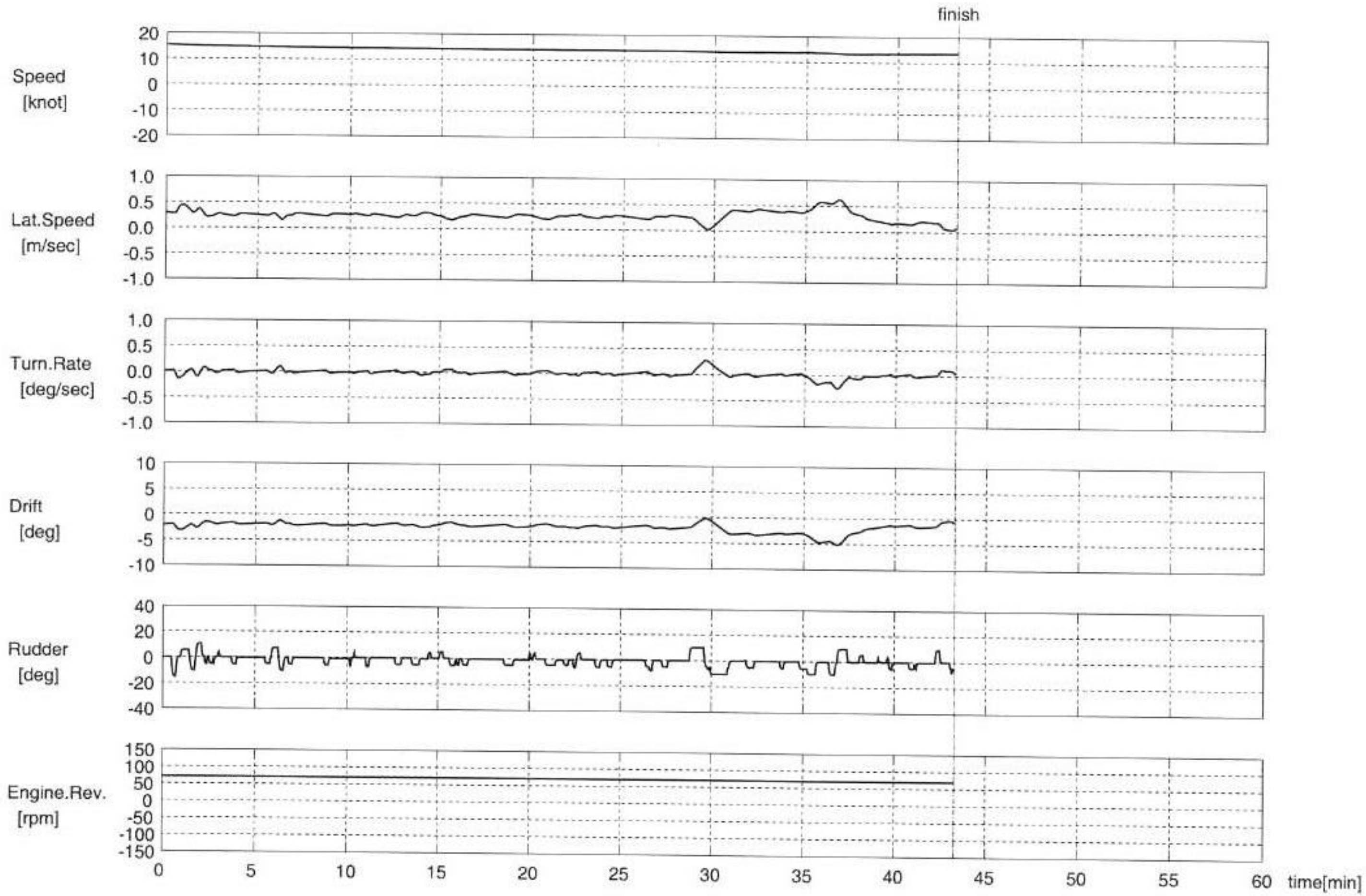


Figure 8.2.17. TRAJECTORY OF MANEUVER (CODE 05)



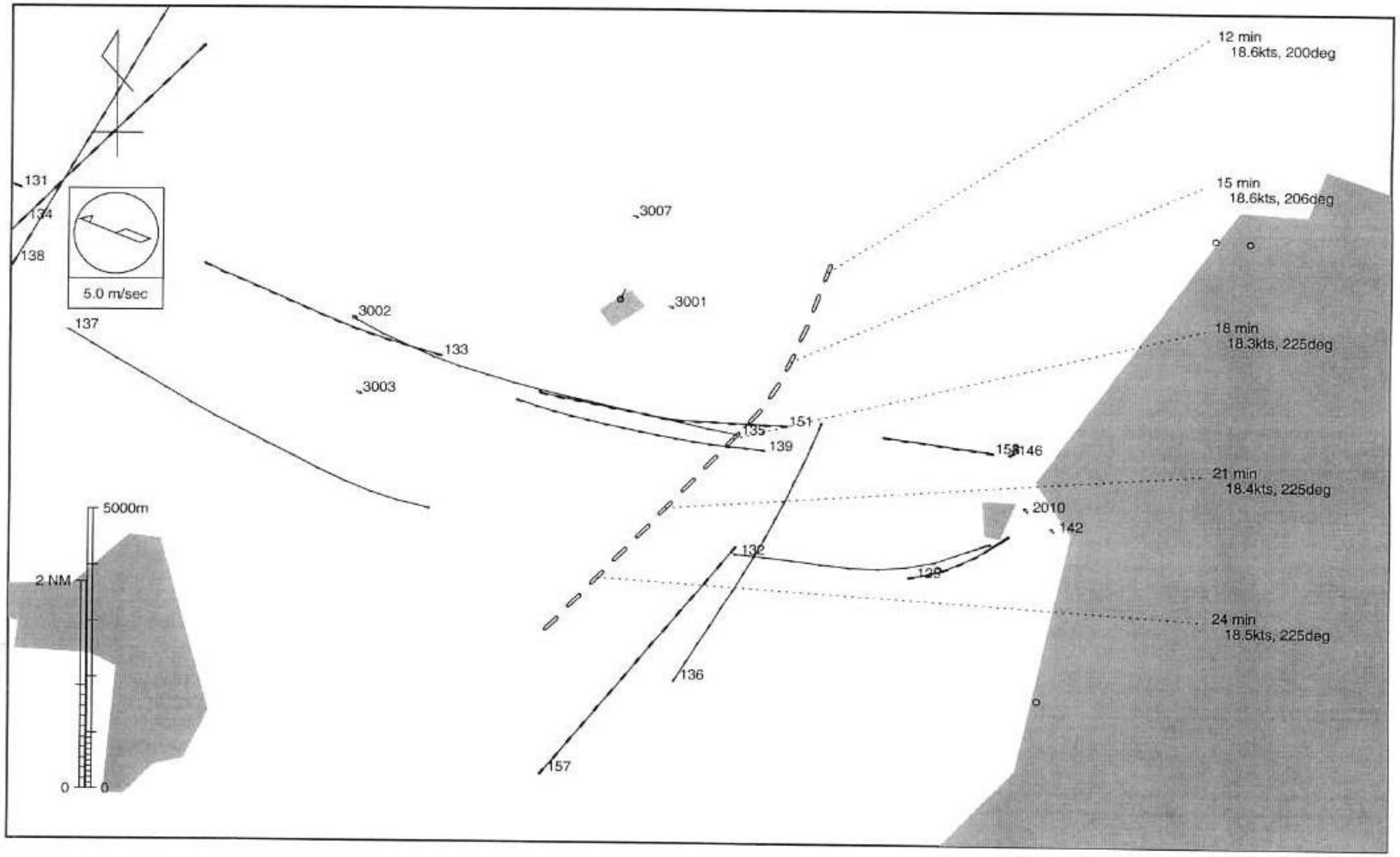
Code	Year	Draft	Channel	Bound	Tidal Current	Wind	TSS
Code 05	2007	20.5m	East	North	South 1.25 knots	ESE 5m/sec	Nil

Figure 8.2.18. TIME HISTORY OF MANEUVERING (CODE 05)



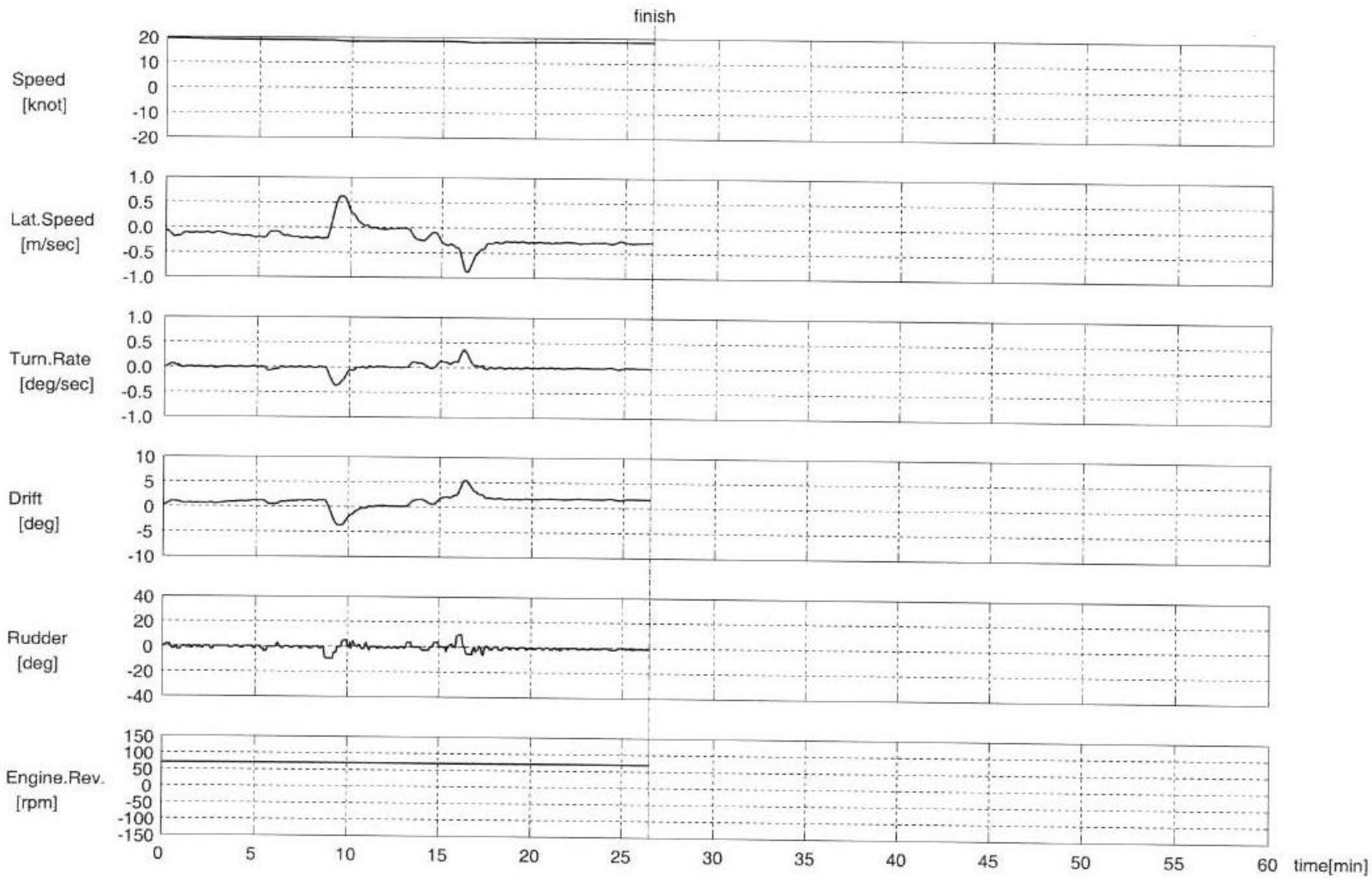
Code	Year	Draft	Channel	Bound	Tidal Current	Wind	TSS
Code 05	2007	20.5m	East	North	South 1.25 knots	ESE 5m/sec	Nil

Figure 8.2.19. TRAJECTORY OF MANEUVER (CODE 06)



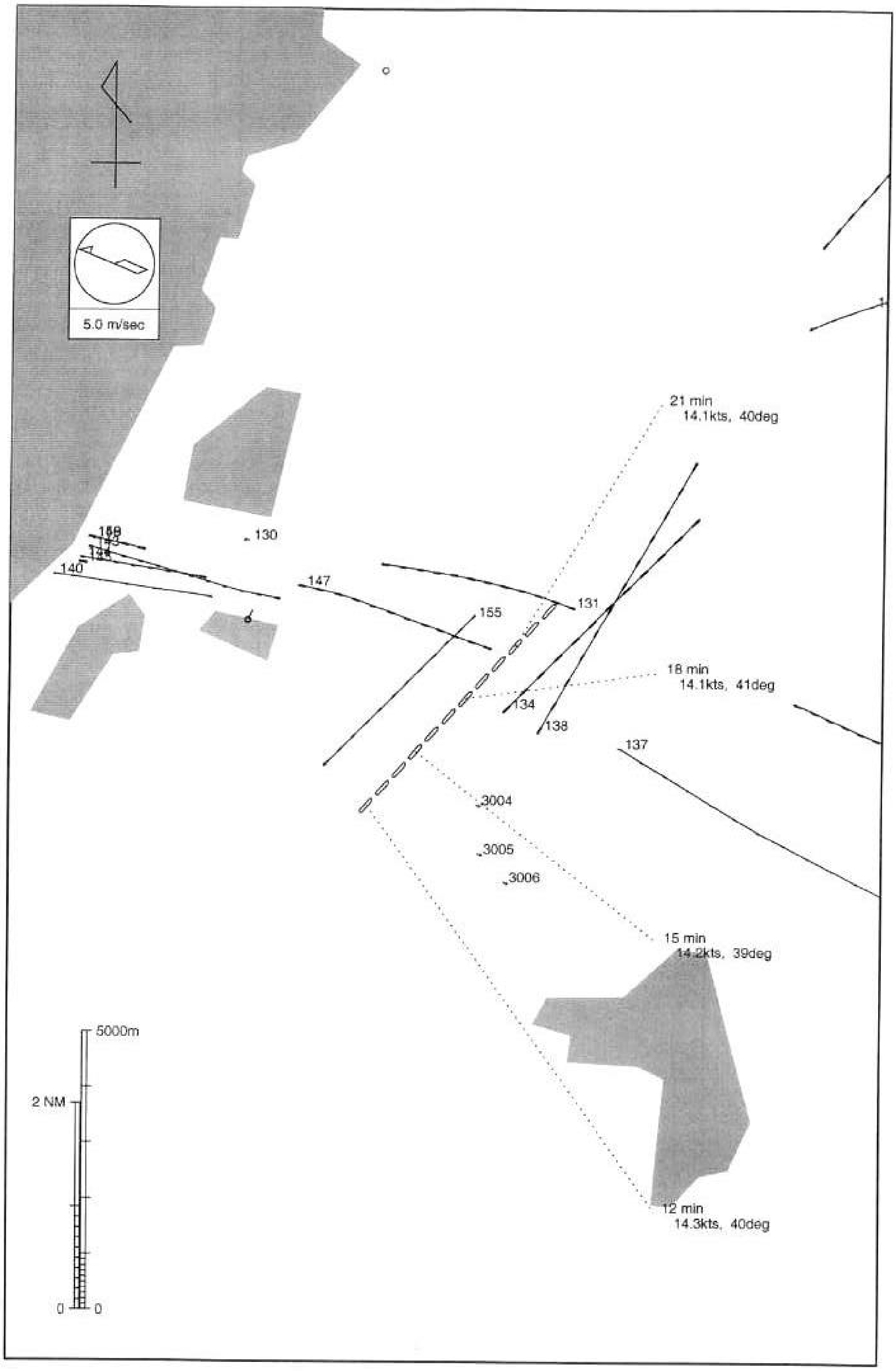
Code	Year	Draft	Channel	Bound	Tidal Current	Wind	TSS
Code 06	2007	10.5m	East	South	South 1.25 knots	ESE 5m/sec	Nil

Figure 8.2.20. TIME HISTORY OF MANEUVERING (CODE 06)



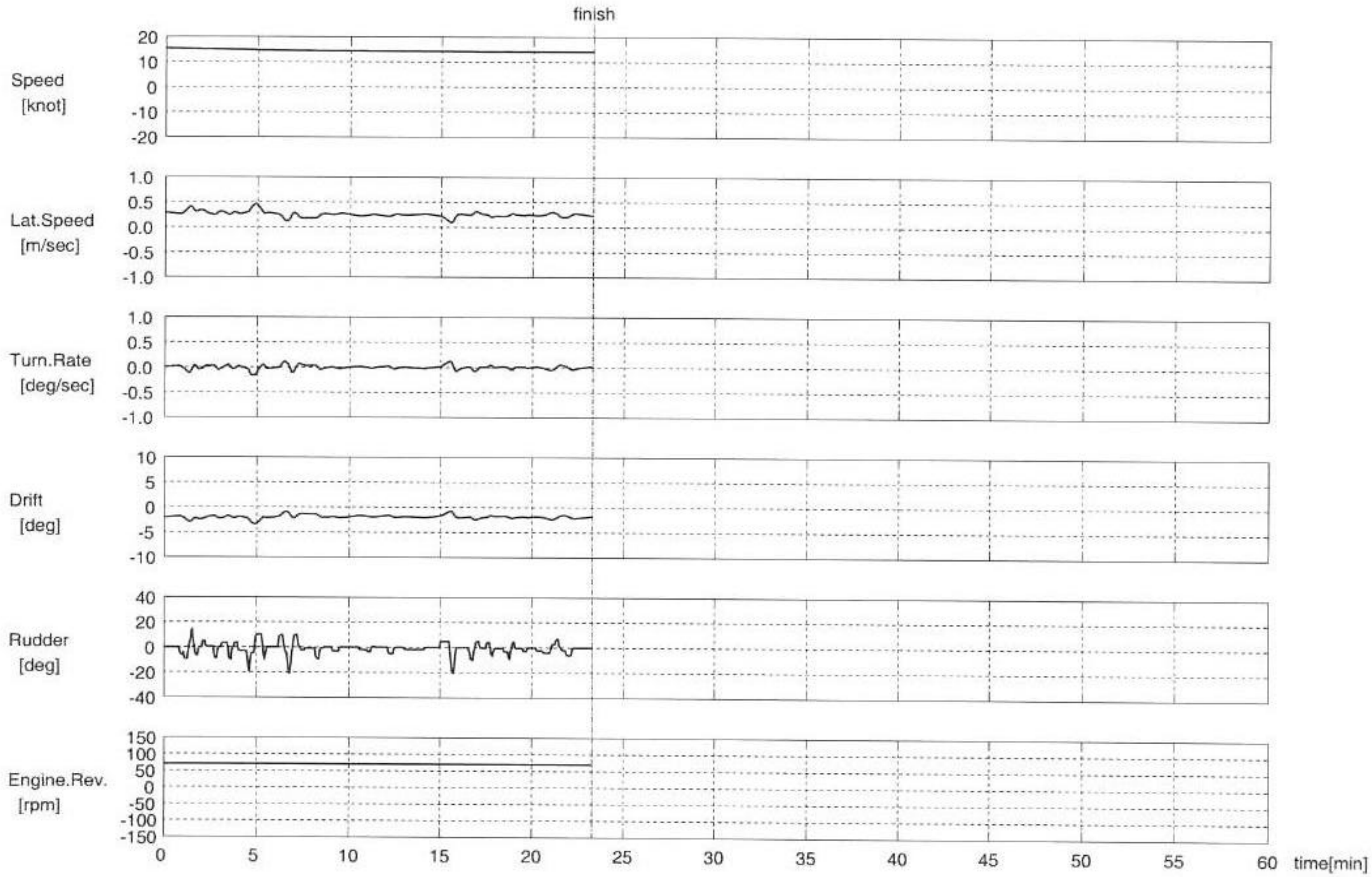
Code	Year	Draft	Channel	Bound	Tidal Current	Wind	TSS
Code 06	2007	10.5m	East	South	South 1.25 knots	ESE 5m/sec	Nil

Figure 8.2.21. TRAJECTORY OF MANEUVER (CODE 07)



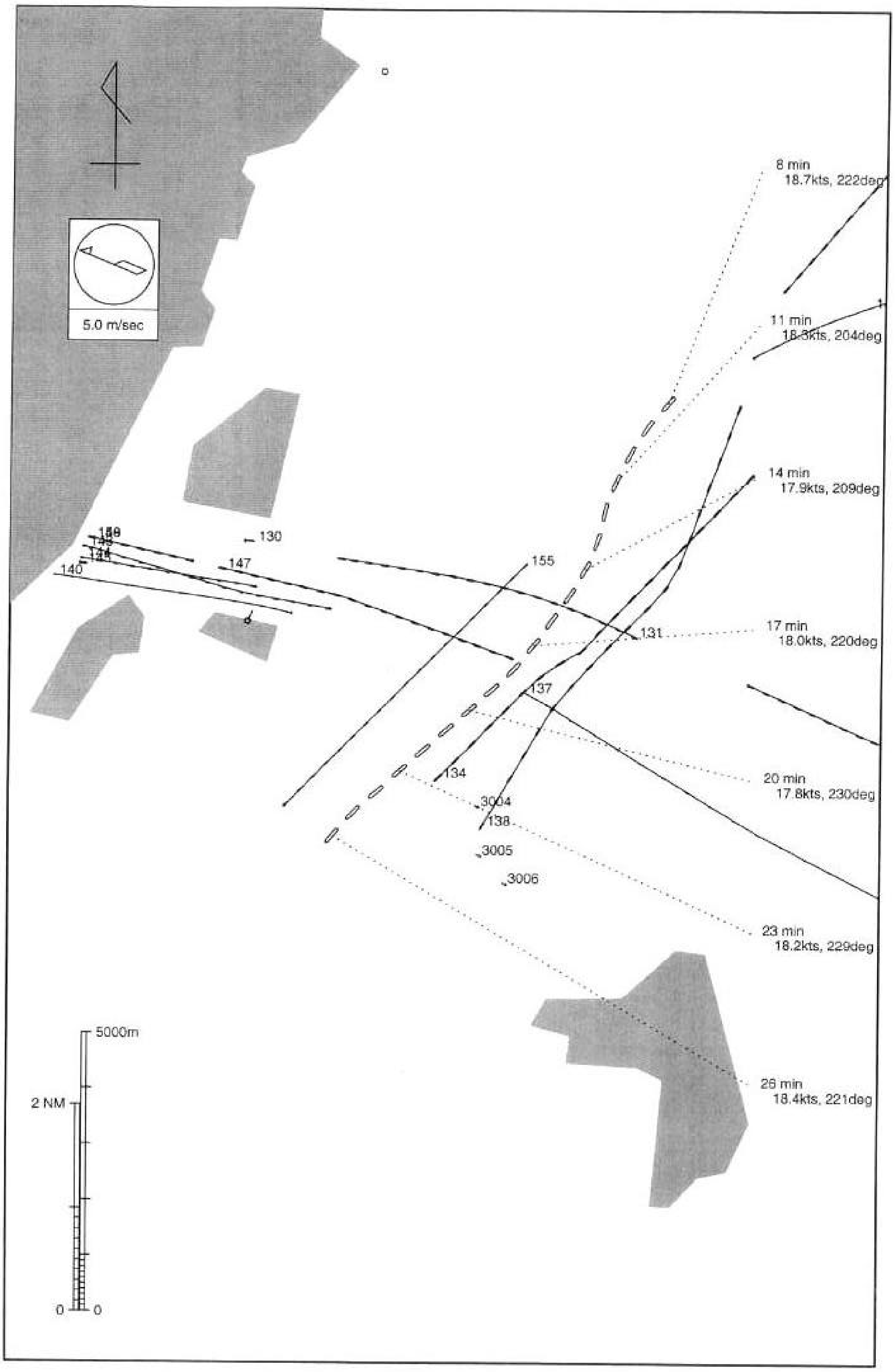
Code	Year	Draft	Channel	Bound	Tidal Current	Wind	TSS
Code 07	2007	20.5m	West	North	South 1.25 knots	ESE 5m/sec	Nil

Figure 8.2.22. TIME HISTORY OF MANEUVERING (CODE 07)



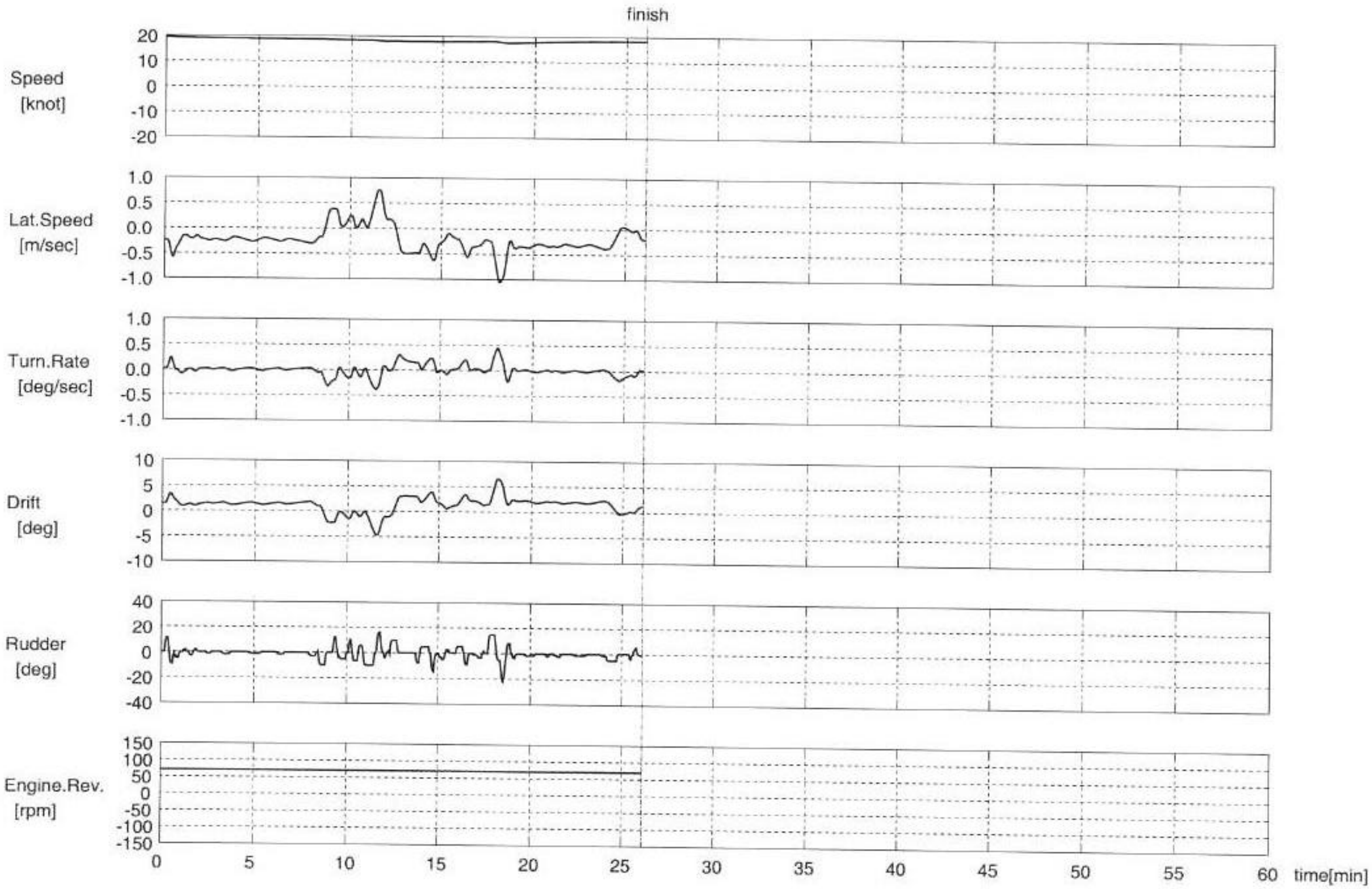
Code	Year	Draft	Channel	Bound	Tidal Current	Wind	TSS
Code 07	2007	20.5m	West	North	South 1.25 knots	ESE 5m/sec	Nil

Figure 8.2.23. TRAJECTORY OF MANEUVER (CODE 08)



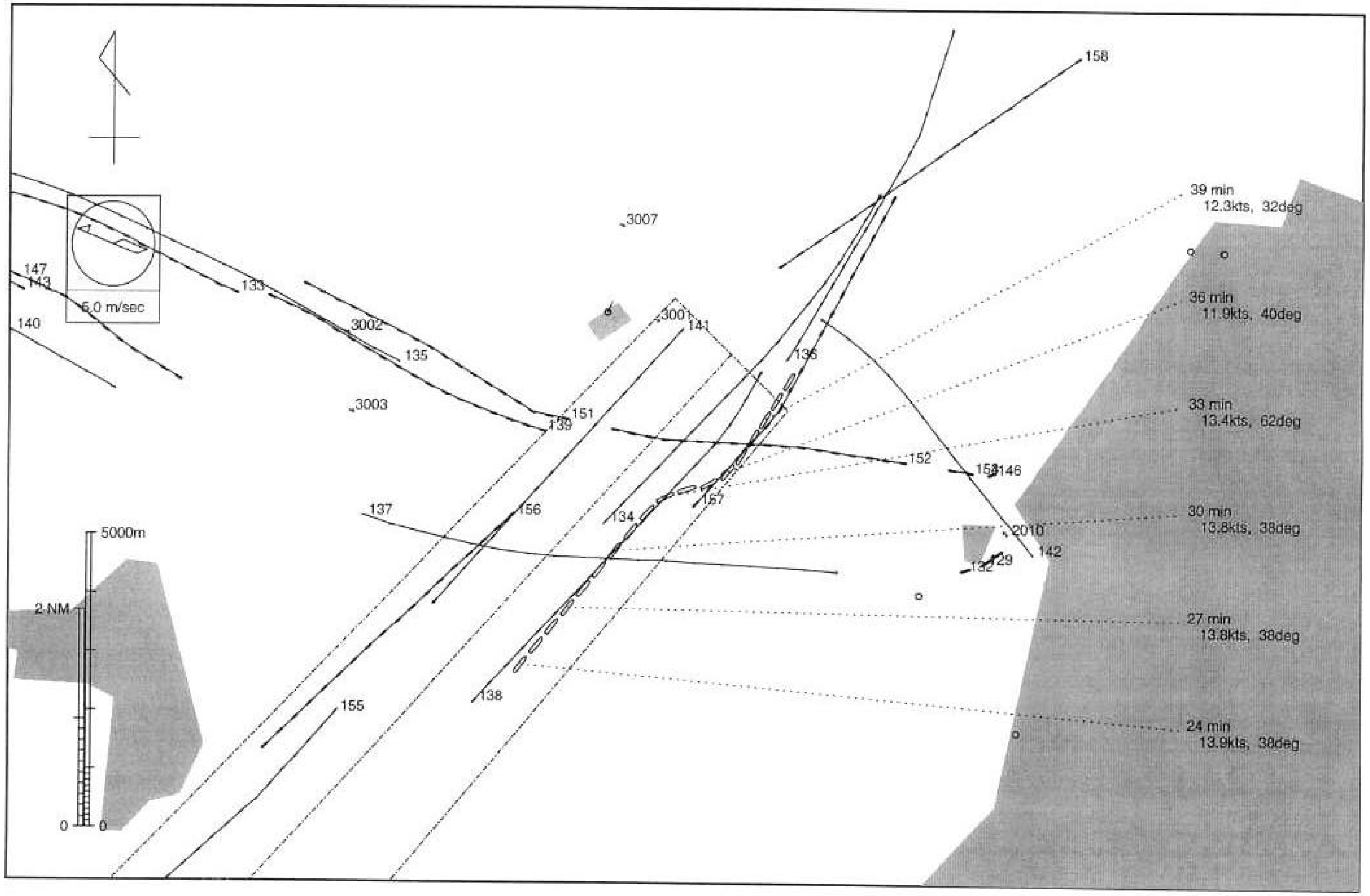
Code	Year	Draft	Channel	Bound	Tidal Current	Wind	TSS
Code 08	2007	10.5m	West	South	South 1.25 knots	ESE 5m/sec	Nil

Figure 8.2.24. TIME HISTORY OF MANEUVERING (CODE 08)



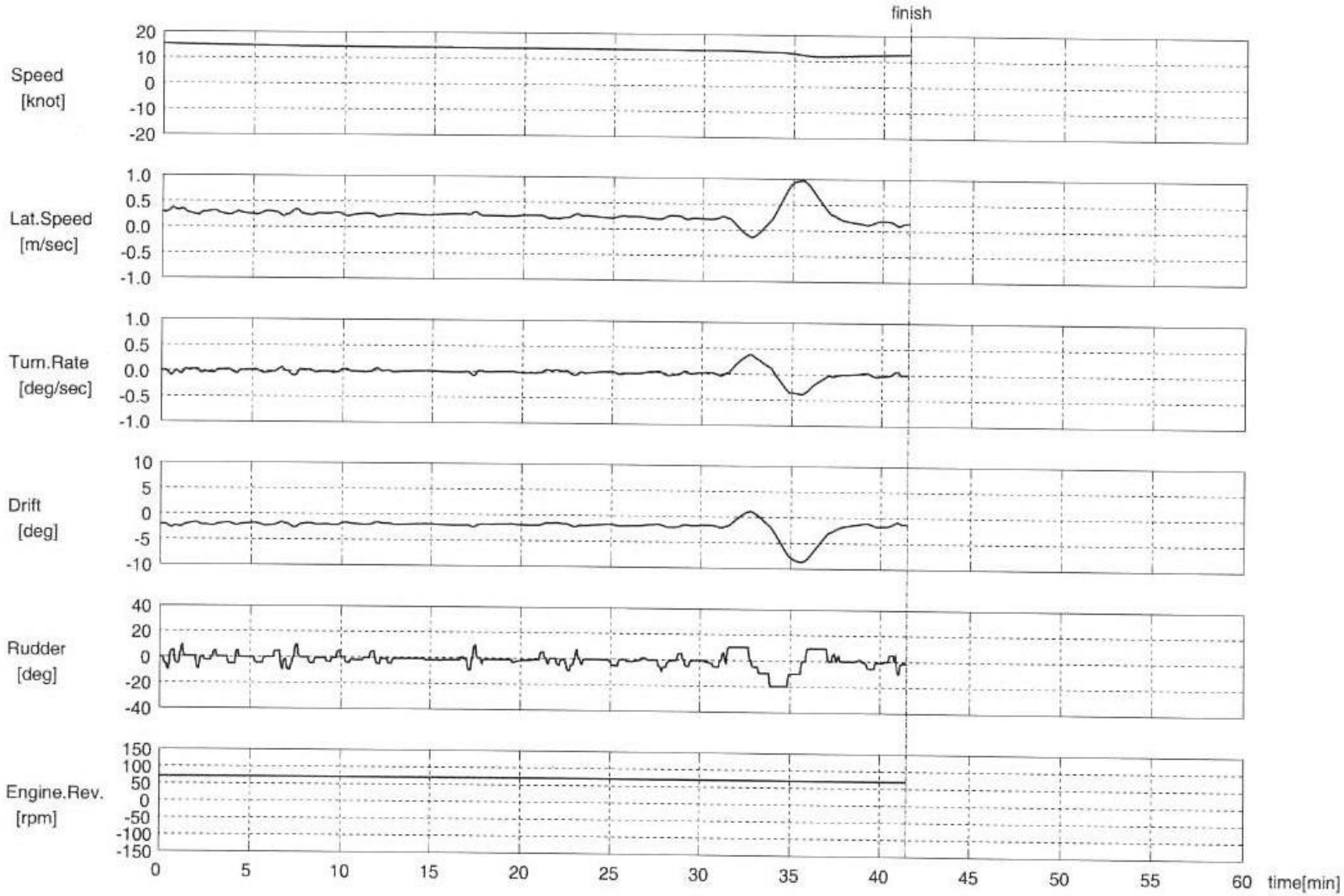
Code	Year	Draft	Channel	Bound	Tidal Current	Wind	TSS
Code 08	2007	10.5m	West	South	South 1.25 knots	ESE 5m/sec	Nil

Figure 8.2.25. TRAJECTORY OF MANEUVER (CODE 09)



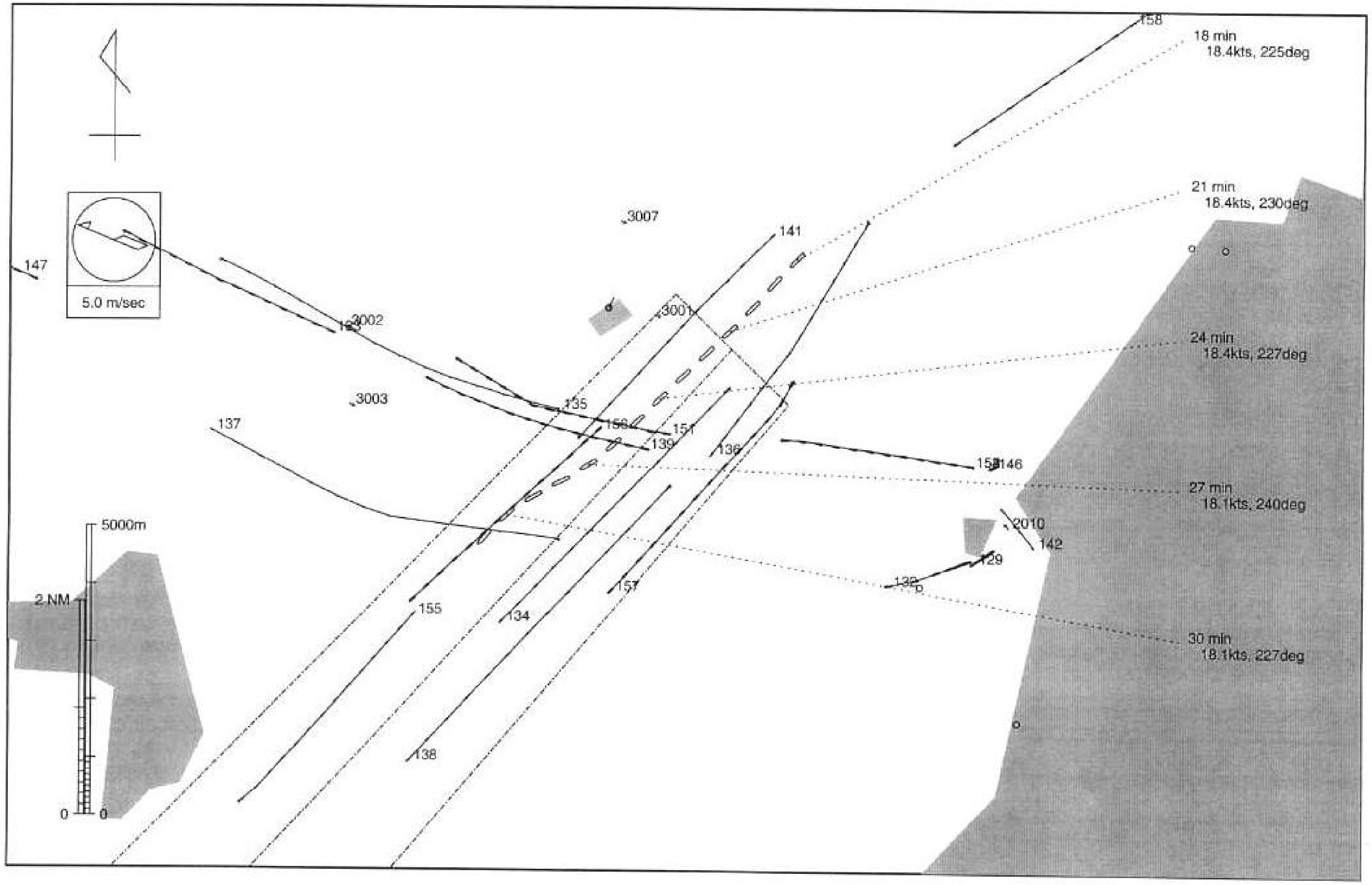
Code	Year	Draft	Channel	Bound	Tidal Current	Wind	TSS
Code 09	2007	20.5m	East	North	South 1.25 knots	ESE 5m/sec	Case I

Figure 8.2.26. TIME HISTORY OF MANEUVERING (CODE 09)



Code	Year	Draft	Channel	Bound	Tidal Current	Wind	TSS
Code 09	2007	20.5m	East	North	South 1.25 knots	ESE 5m/sec	Case I

Figure 8.2.27. TRAJECTORY OF MANEUVER (CODE 10)



Code	Year	Draft	Channel	Bound	Tidal Current	Wind	TSS
Code 10	2007	10.5m	East	South	South 1.25 knots	ESE 5m/sec	Case I

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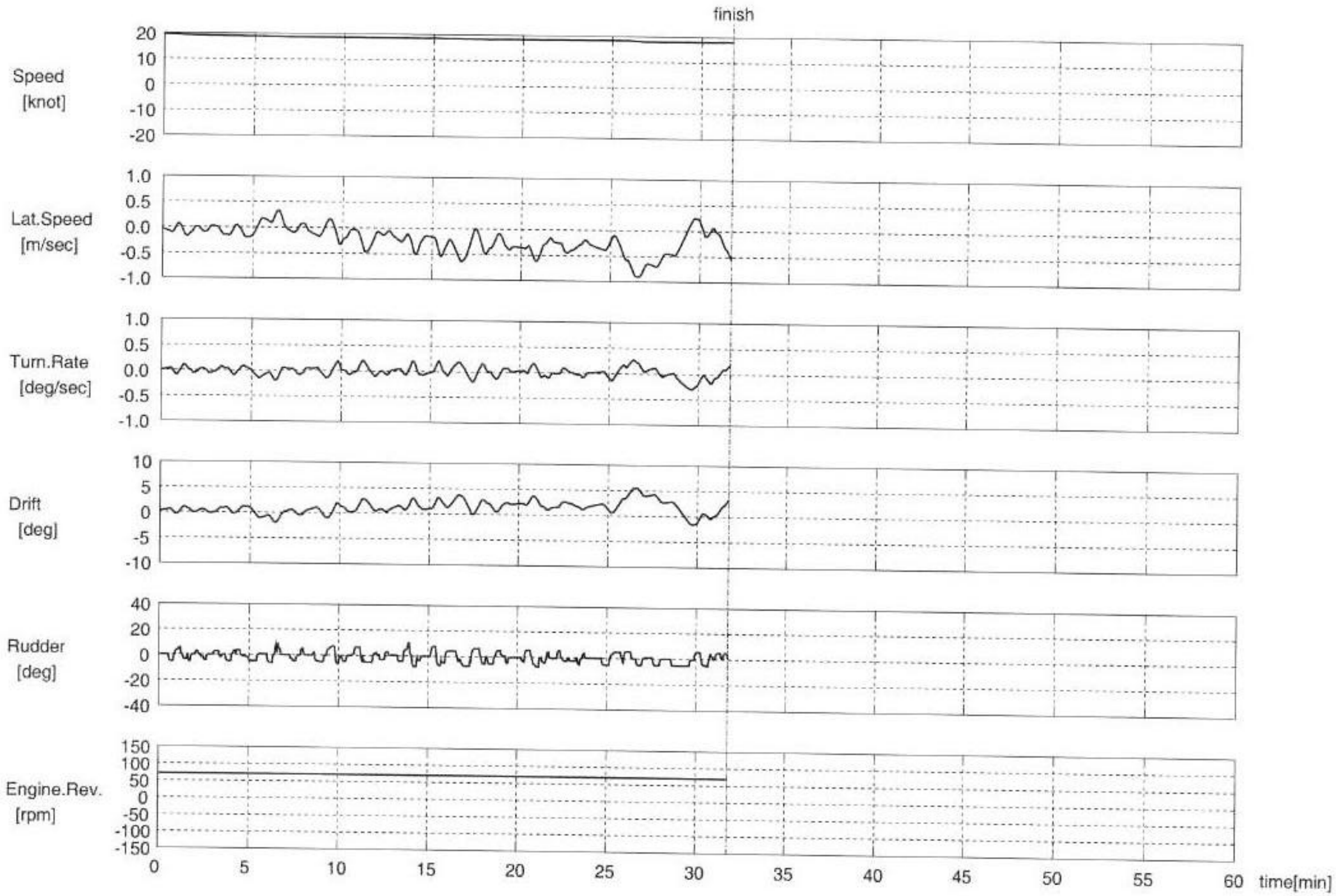
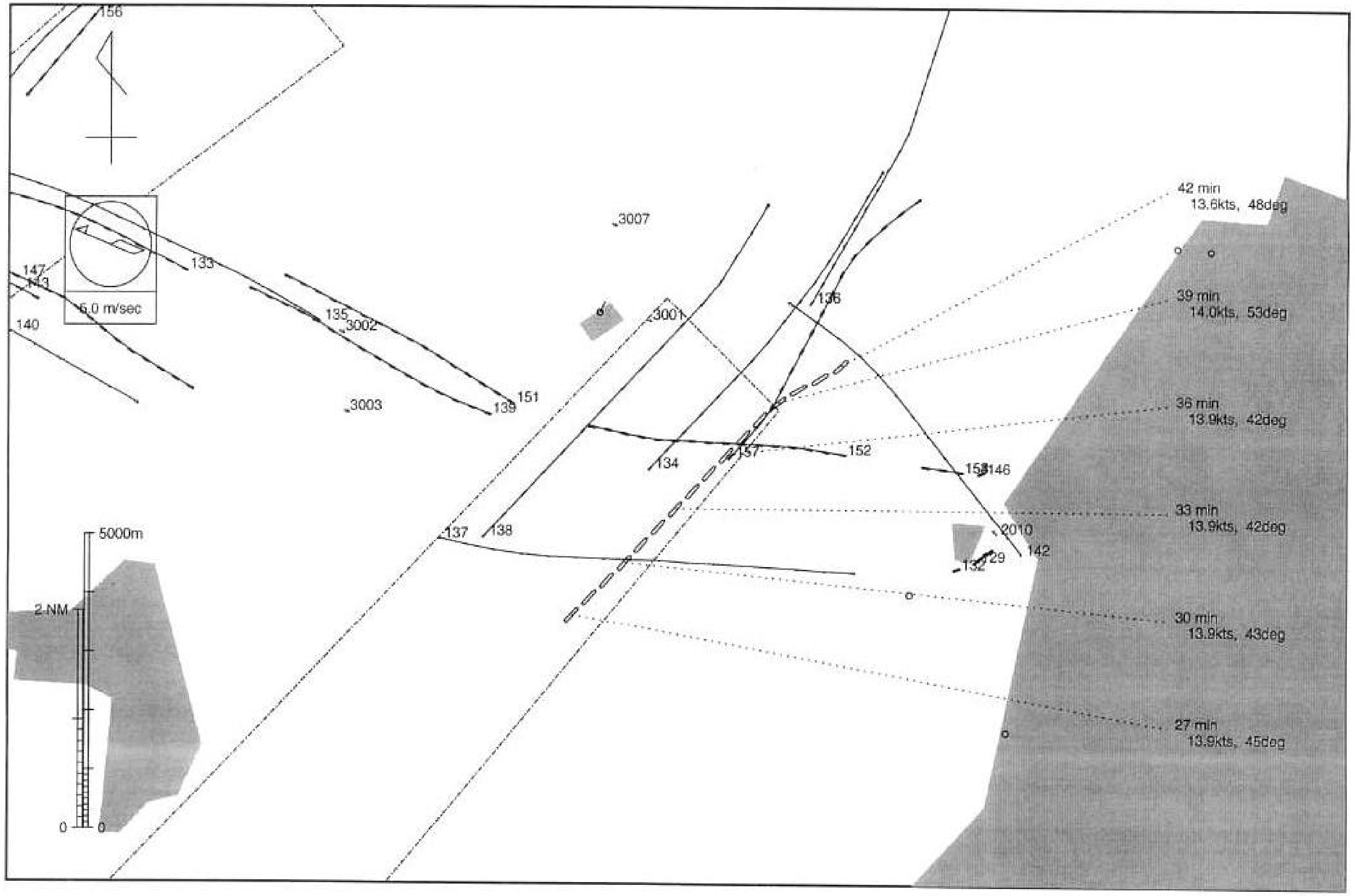
Figure 8.2.28. TIME HISTORY OF MANEUVERING (CODE 10)



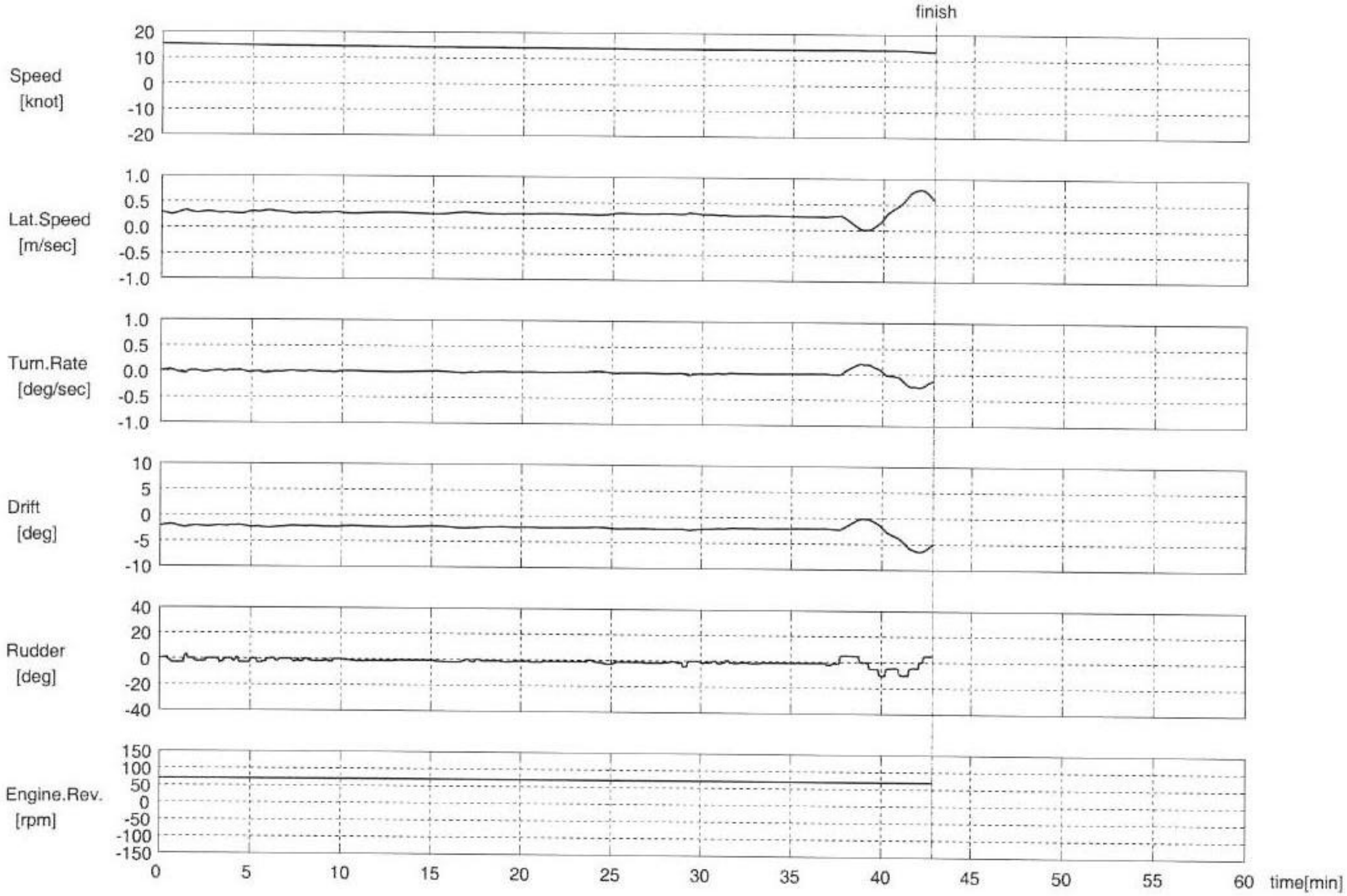
Code	Year	Draft	Channel	Bound	Tidal Current	Wind	TSS
Code 10	2007	10.5m	East	South	South 1.25 knots	ESE 5m/sec	Case I

Figure 8.2.29. TRAJECTORY OF MANEUVER (CODE 11)



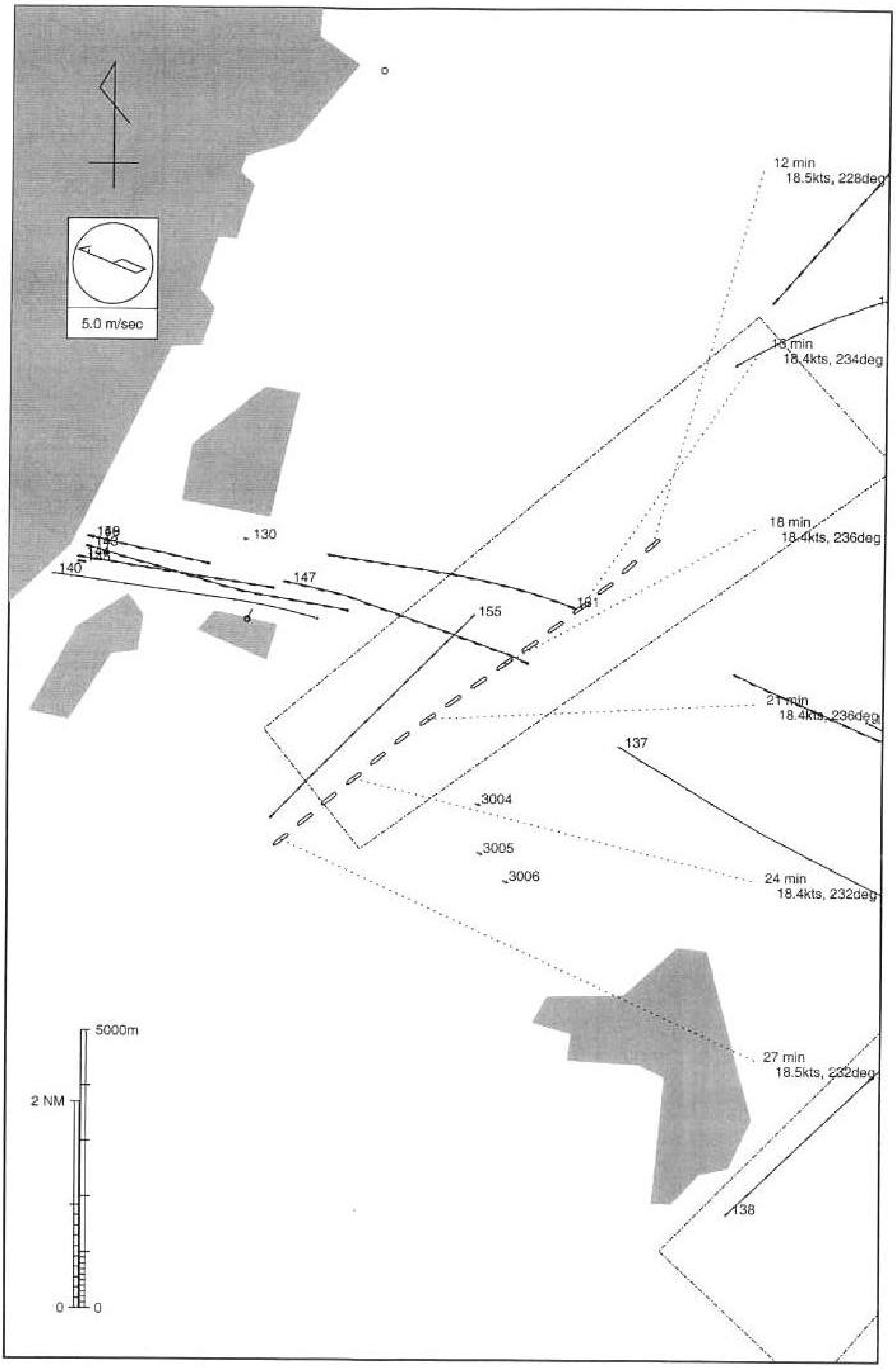
Code	Year	Draft	Channel	Bound	Tidal Current	Wind	TSS
Code 11	2007	20.5m	East	North	South 1.25 knots	ESE 5m/sec	Case II

Figure 8.2.30. TIME HISTORY OF MANEUVERING (CODE 11)



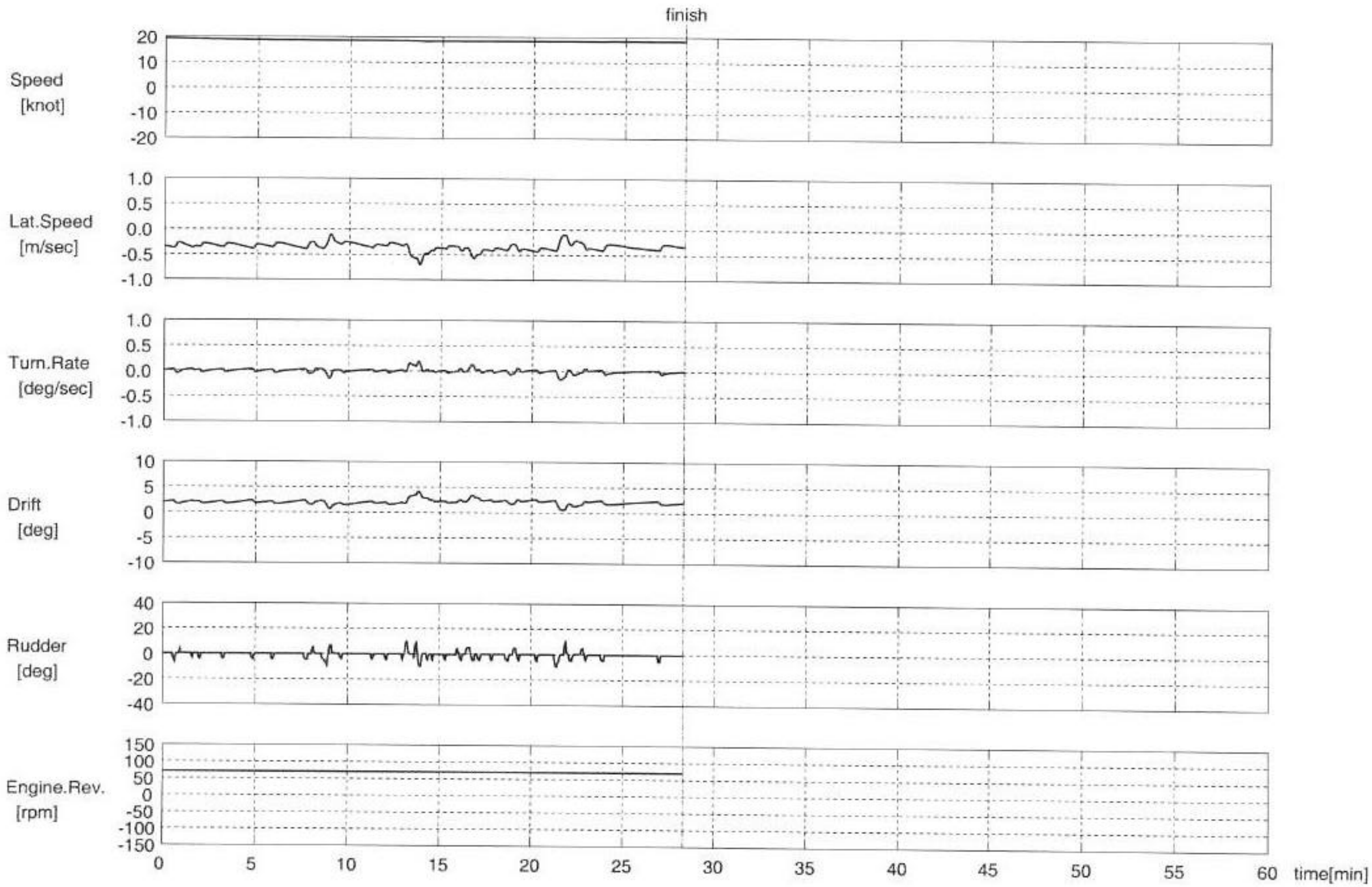
Code	Year	Draft	Channel	Bound	Tidal Current	Wind	TSS
Code 11	2007	20.5m	East	North	South 1.25 knots	ESE 5m/sec	Case II

Figure 8.2.31. TRAJECTORY OF MANEUVER (CODE 12)



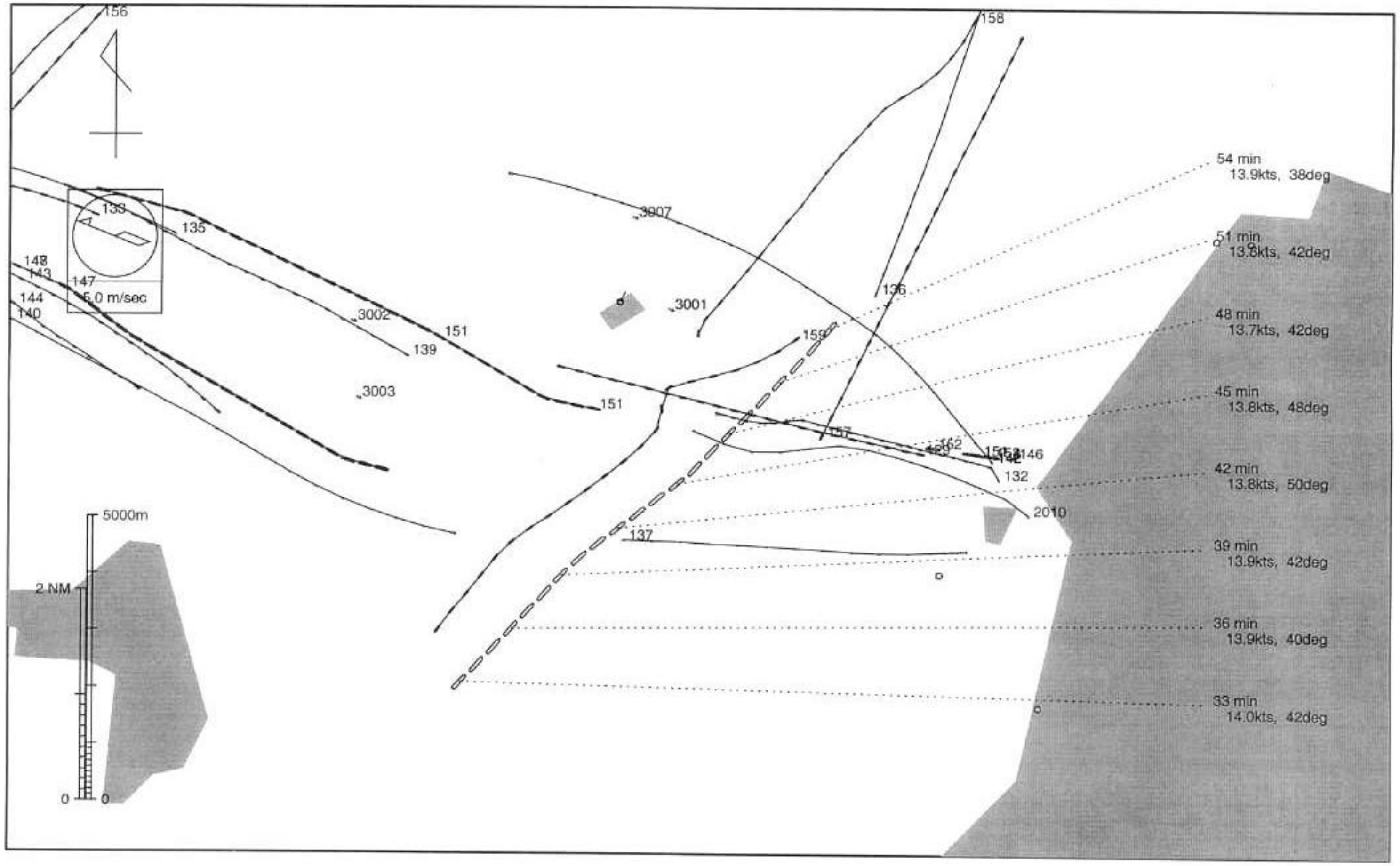
Code	Year	Draft	Channel	Bound	Tidal Current	Wind	TSS
Code 12	2007	10.5m	West	South	South 1.25 knots	ESE 5m/sec	Case II

Figure 8.2.32. TIME HISTORY OF MANEUVERING (CODE 12)



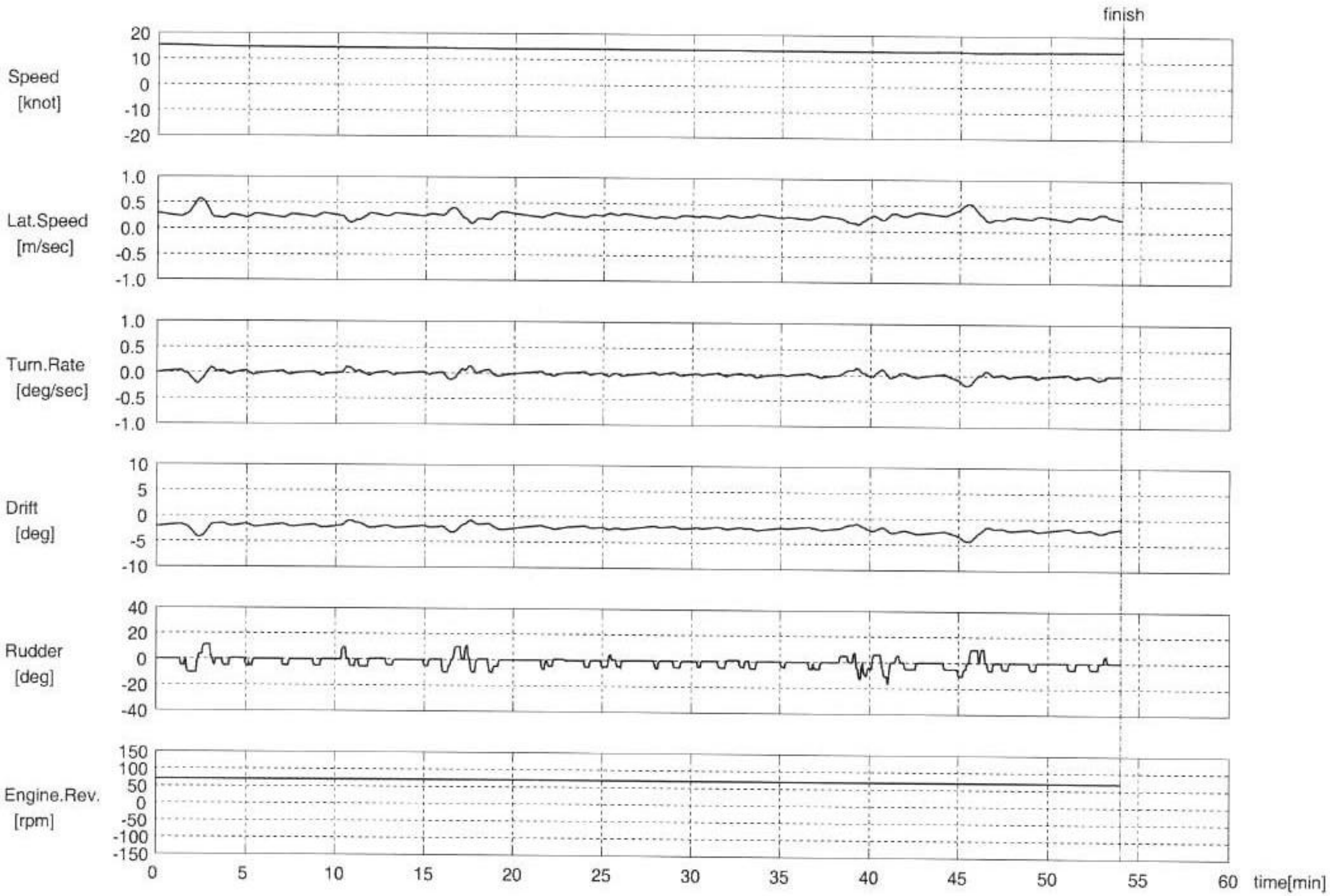
Code	Year	Draft	Channel	Bound	Tidal Current	Wind	TSS
Code 12	2007	10.5m	West	South	South 1.25 knots	ESE 5m/sec	Case II

Figure 8.2.33. TRAJECTORY OF MANEUVER (CODE 13)



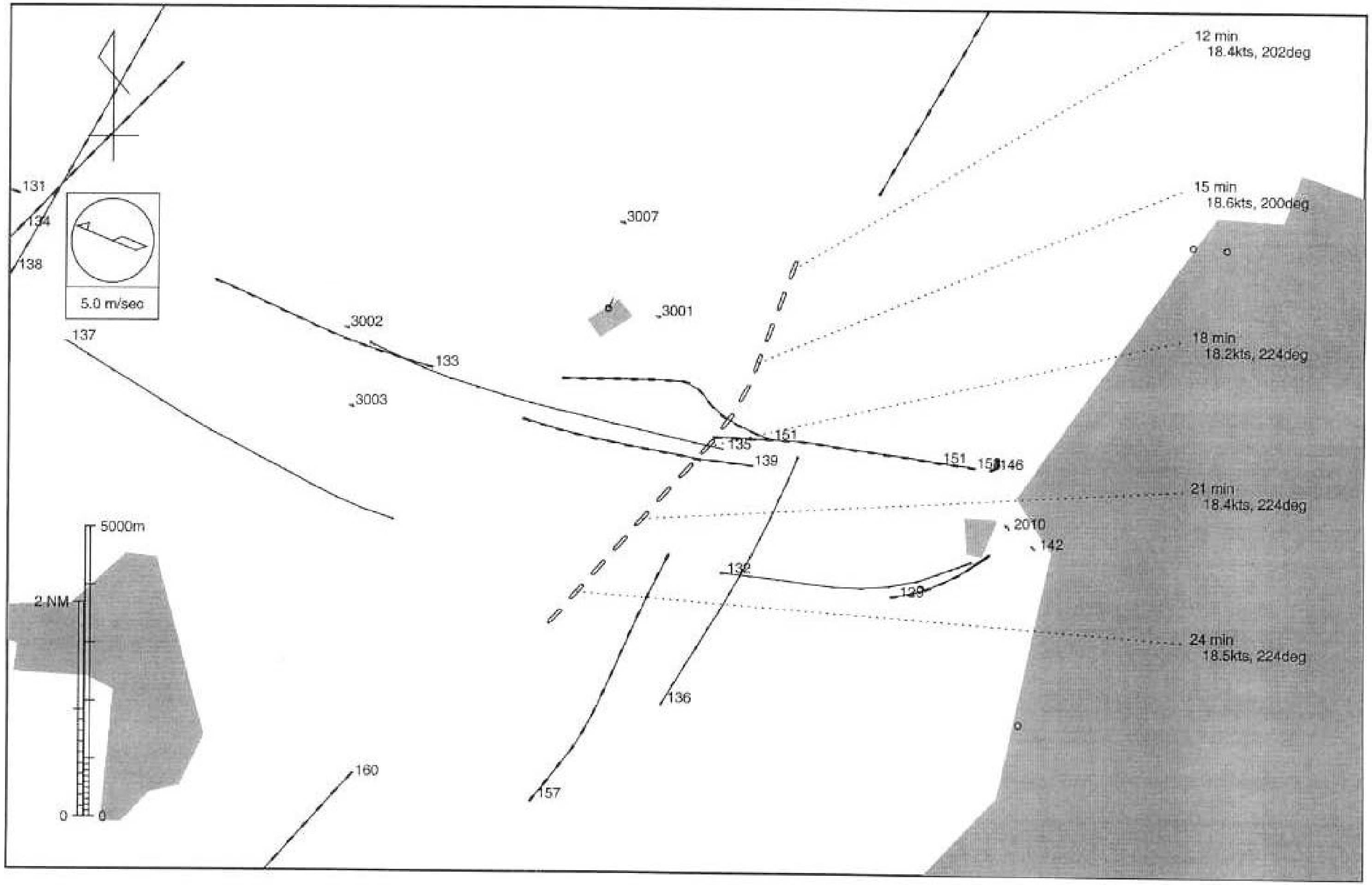
Code	Year	Draft	Channel	Bound	Tidal Current	Wind	TSS
Code 13	2020	20.5m	East	North	South 1.25 knots	ESE 5m/sec	Nil

Figure 8.2.34. TIME HISTORY OF MANEUVERING (CODE 13)



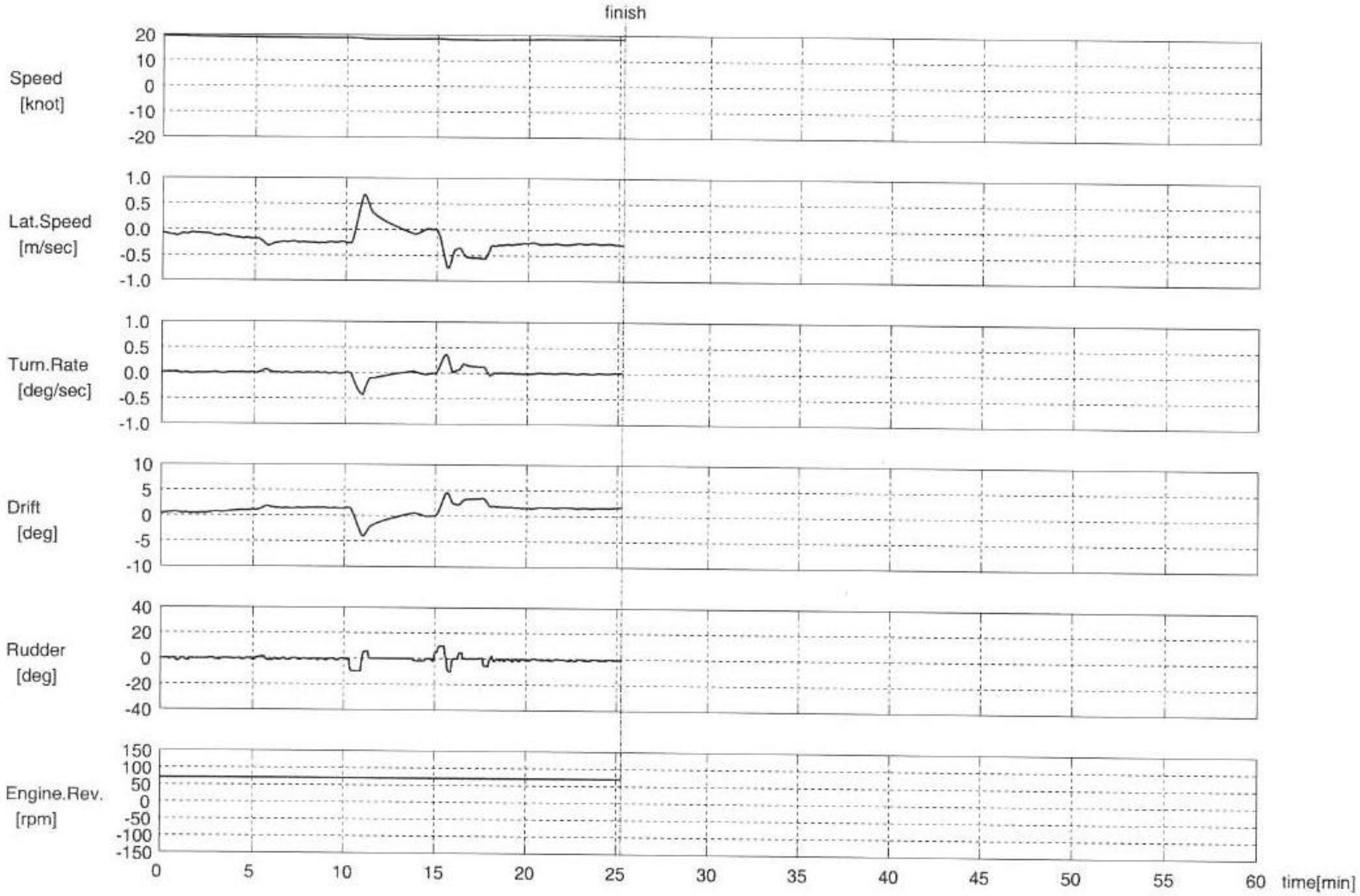
Code	Year	Draft	Channel	Bound	Tidal Current	Wind	TSS
Code 13	2020	20.5m	East	North	South 1.25 knots	ESE 5m/sec	Nil

Figure 8.2.35. TRAJECTORY OF MANEUVER (CODE 14)



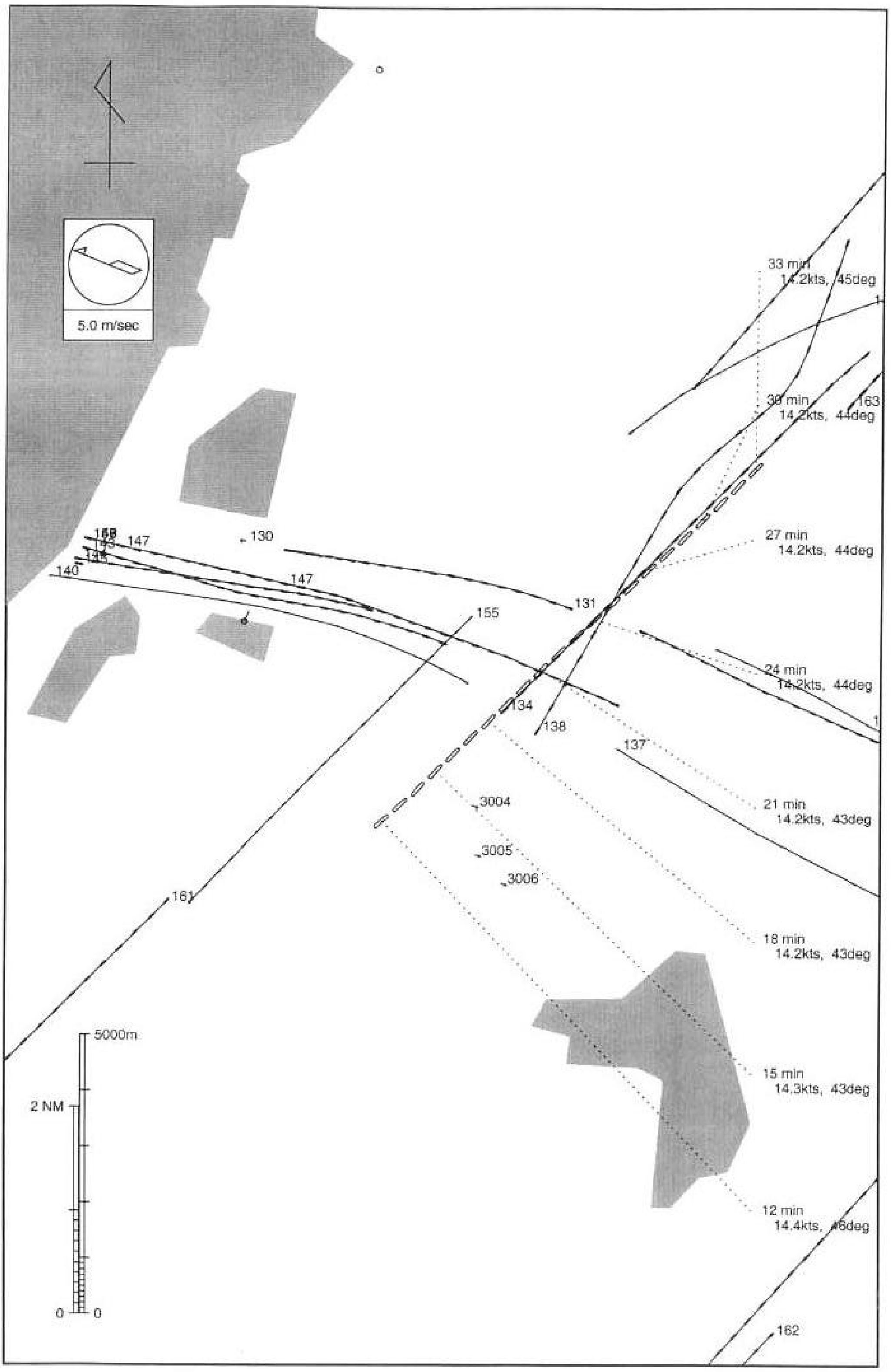
Code	Year	Draft	Channel	Bound	Tidal Current	Wind	TSS
Code 14	2020	10.5m	East	South	South 1.25 knots	ESE 5m/sec	Nil

Figure 8.2.36. TIME HISTORY OF MANEUVERING (CODE 14)



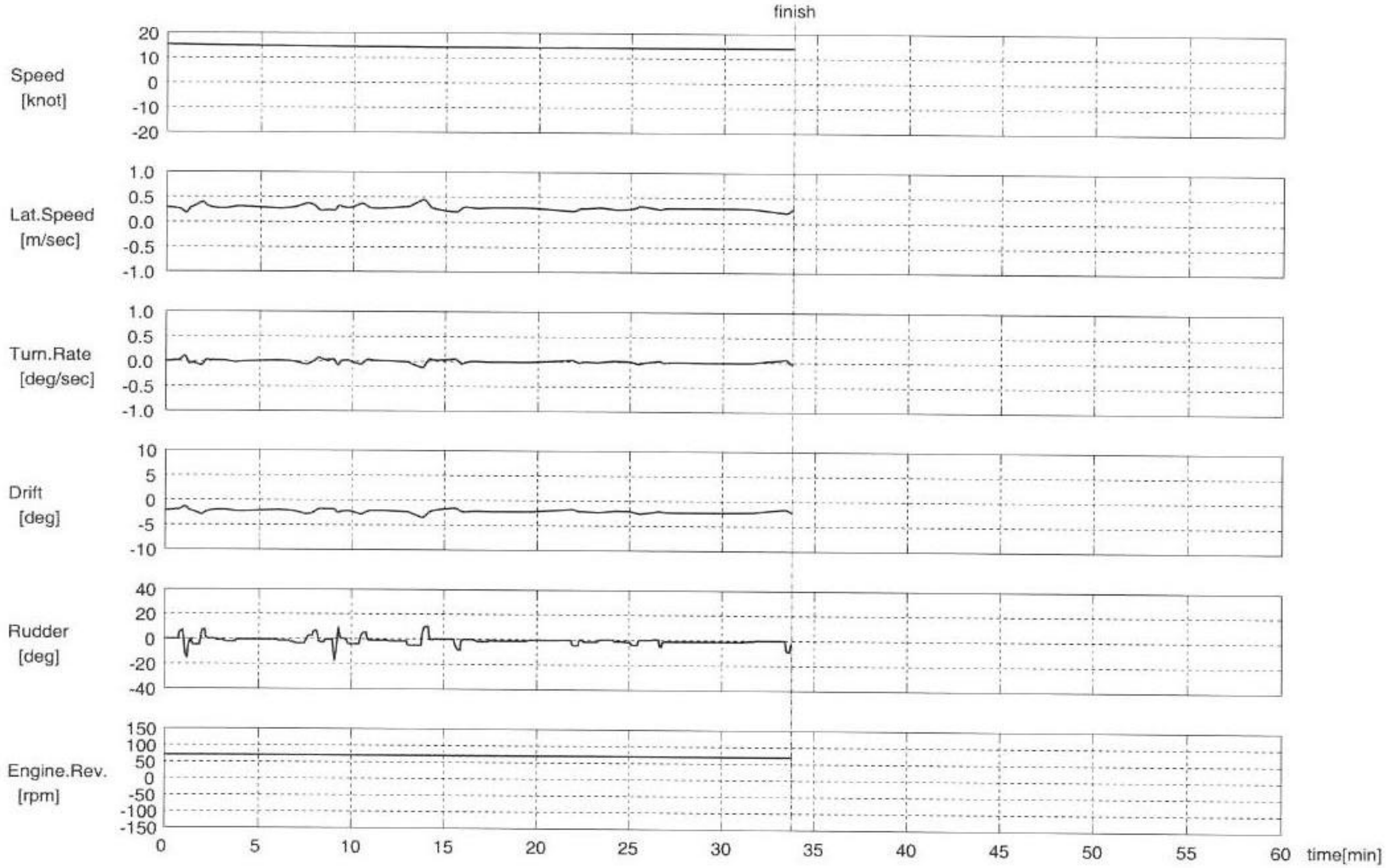
Code	Year	Draft	Channel	Bound	Tidal Current	Wind	TSS
Code 14	2020	10.5m	East	South	South 1.25 knots	ESE 5m/sec	Nil

Figure 8.2.37. TRAJECTORY OF MANEUVER (CODE 15)



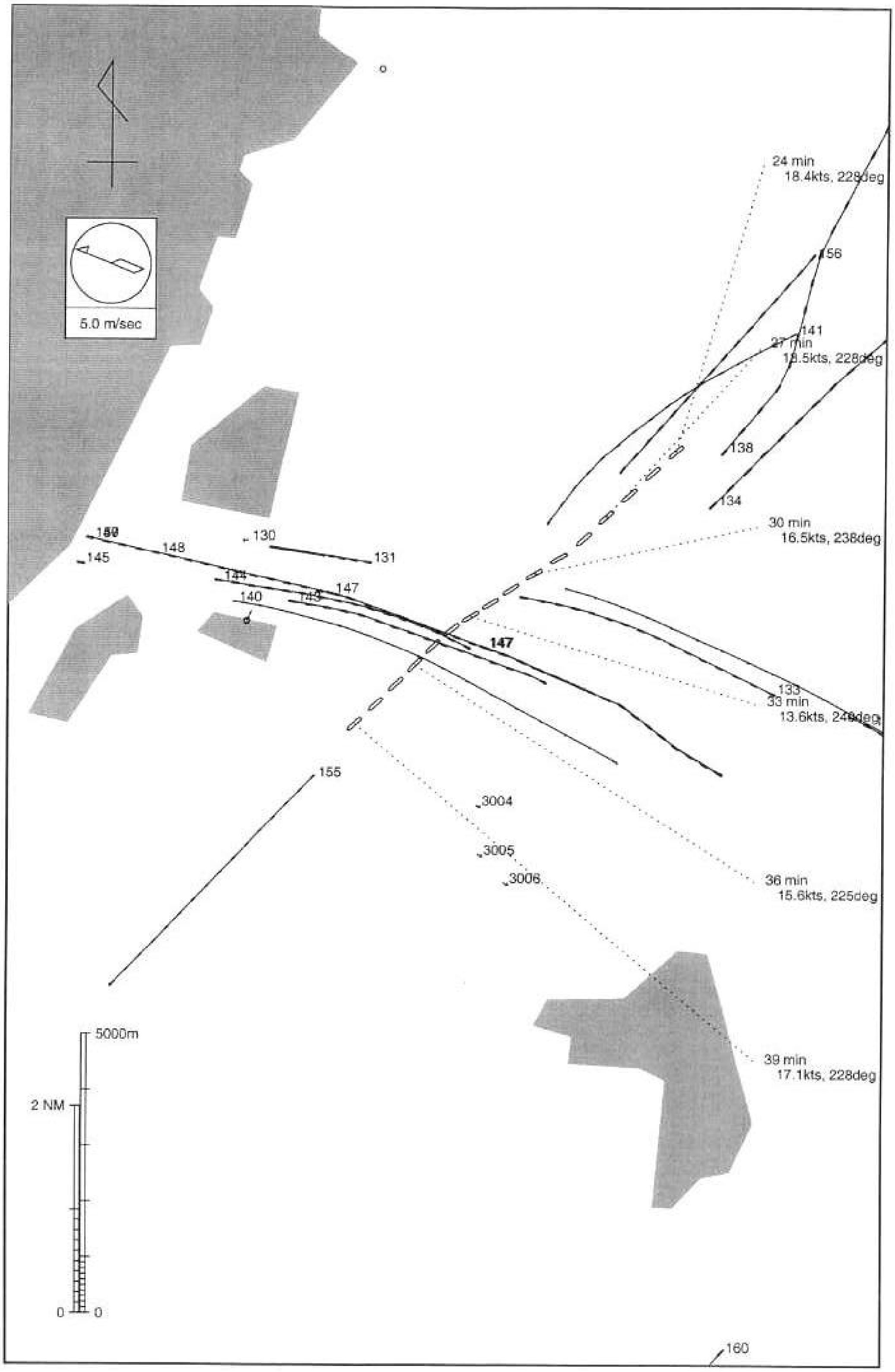
Code	Year	Draft	Channel	Bound	Tidal Current	Wind	TSS
Code 15	2020	20.5m	West	North	South 1.25 knots	ESE 5m/sec	Nil

Figure 8.2.38. TIME HISTORY OF MANEUVERING (CODE 15)



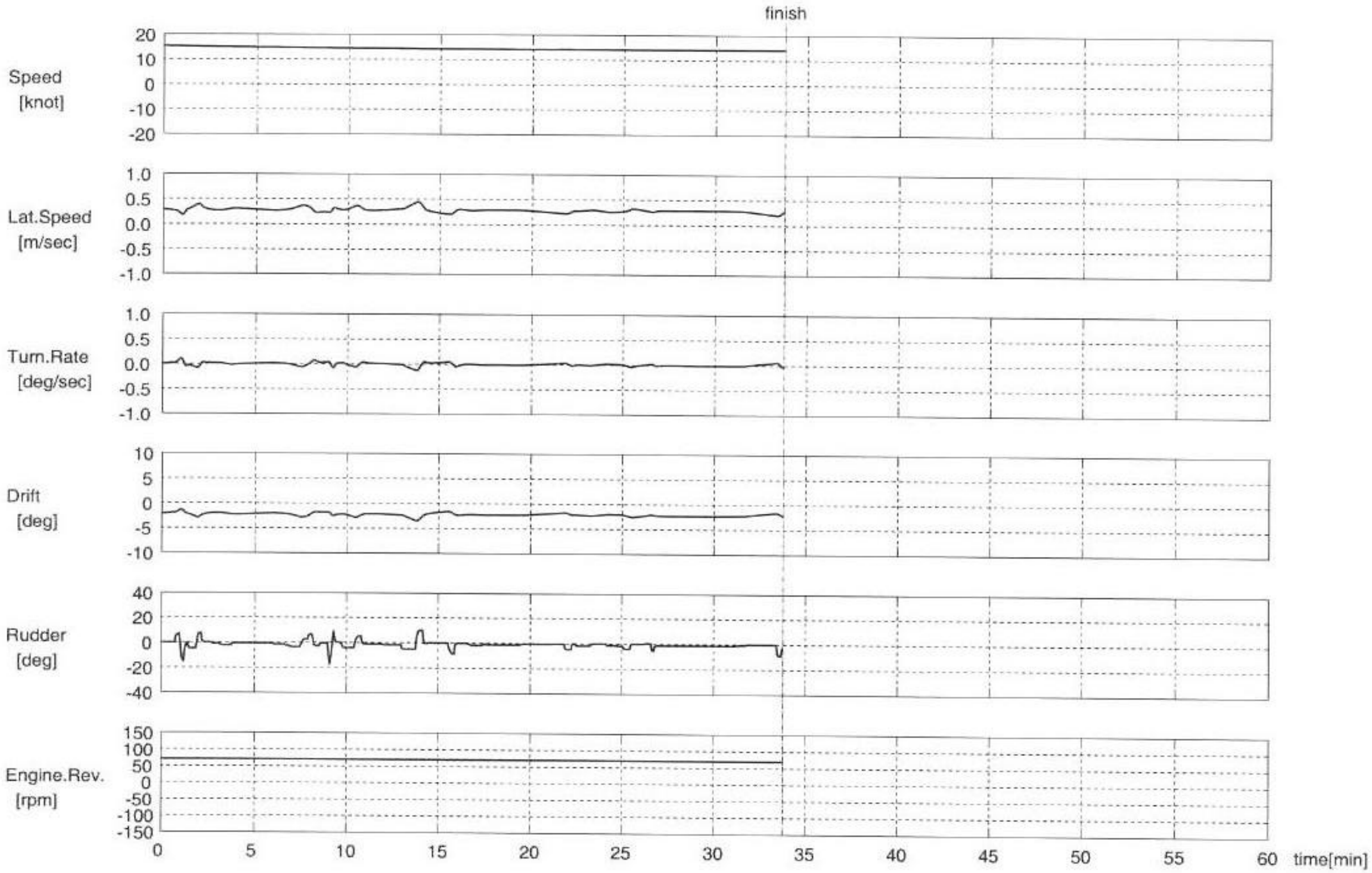
Code	Year	Draft	Channel	Bound	Tidal Current	Wind	TSS
Code 15	2020	20.5m	West	North	South 1.25 knots	ESE 5m/sec	Nil

Figure 8.2.39. TRAJECTORY OF MANEUVER (CODE 16)



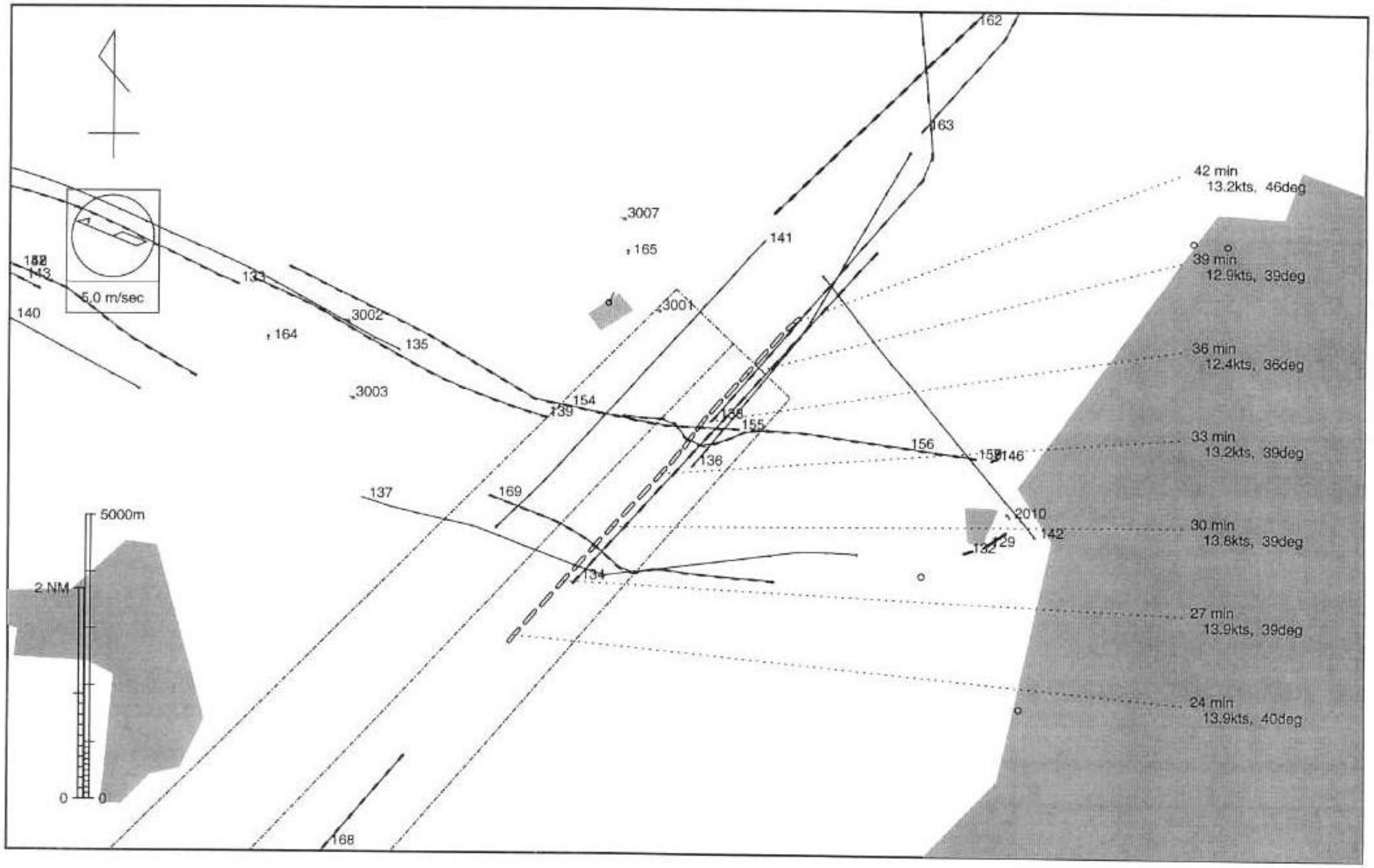
Code	Year	Draft	Channel	Bound	Tidal Current	Wind	TSS
Code 16	2020	10.5m	West	South	South 1.25 knots	ESE 5m/sec	Nil

Figure 8.2.40. TIME HISTORY OF MANEUVERING (CODE 16)



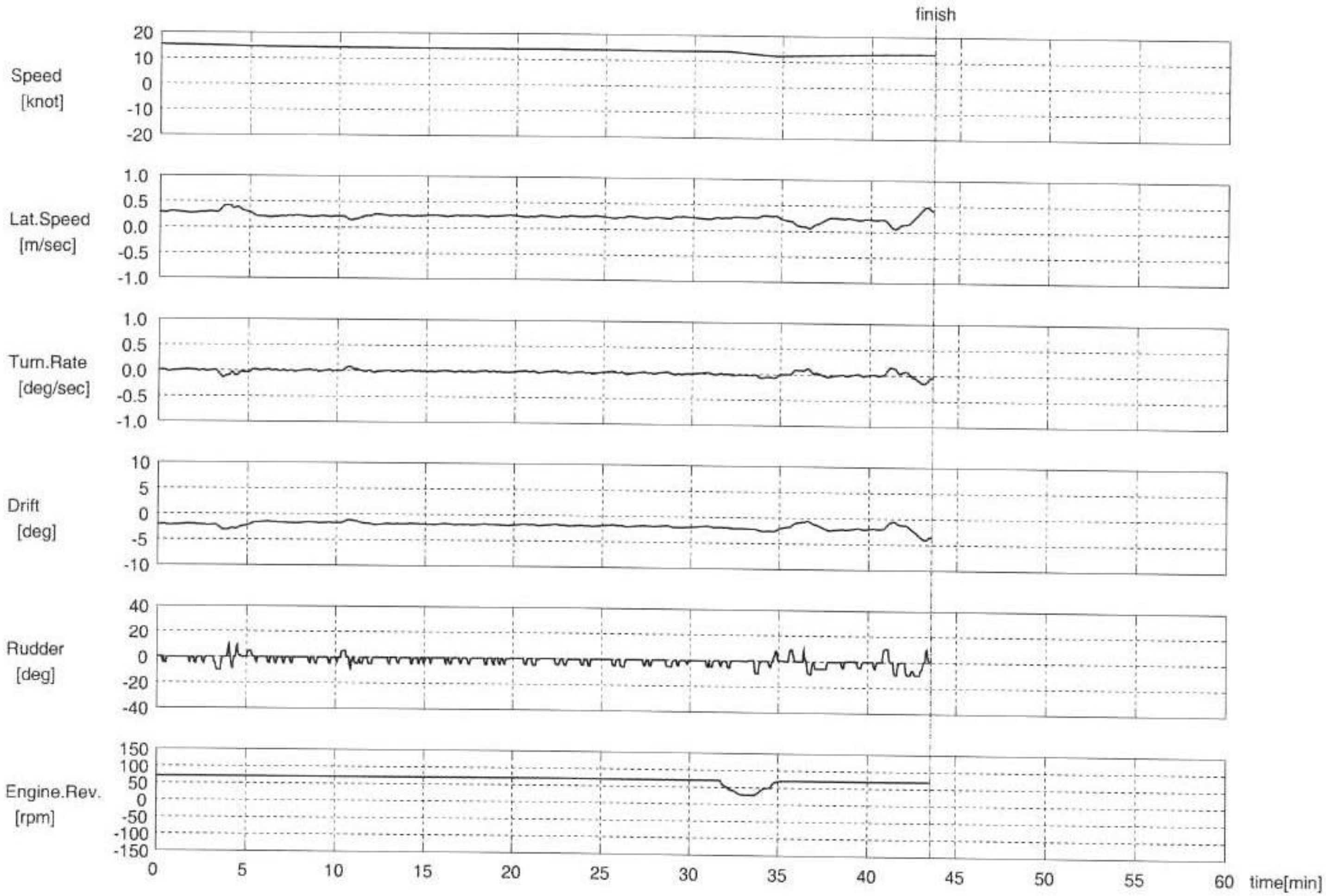
Code	Year	Draft	Channel	Bound	Tidal Current	Wind	TSS
Code 16	2020	10.5m	West	South	South 1.25 knots	ESE 5m/sec	Nil

Figure 8.2.41. TRAJECTORY OF MANEUVER (CODE 17)



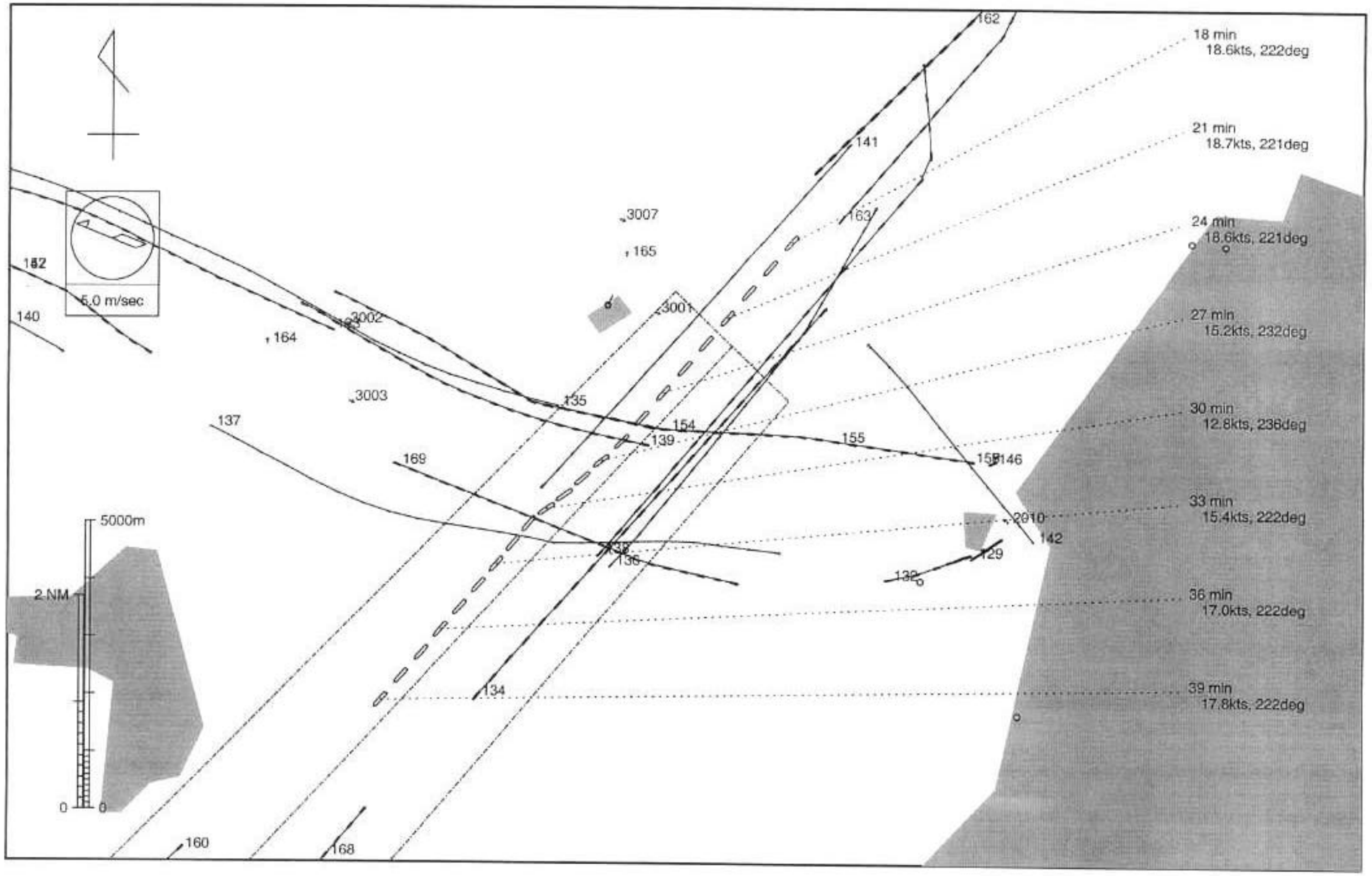
Code	Year	Draft	Channel	Bound	Tidal Current	Wind	TSS
Code 17	2020	20.5m	East	North	South 1.25 knots	ESE 5m/sec	Case I

Figure 8.2.42. TIME HISTORY OF MANEUVERING (CODE 17)



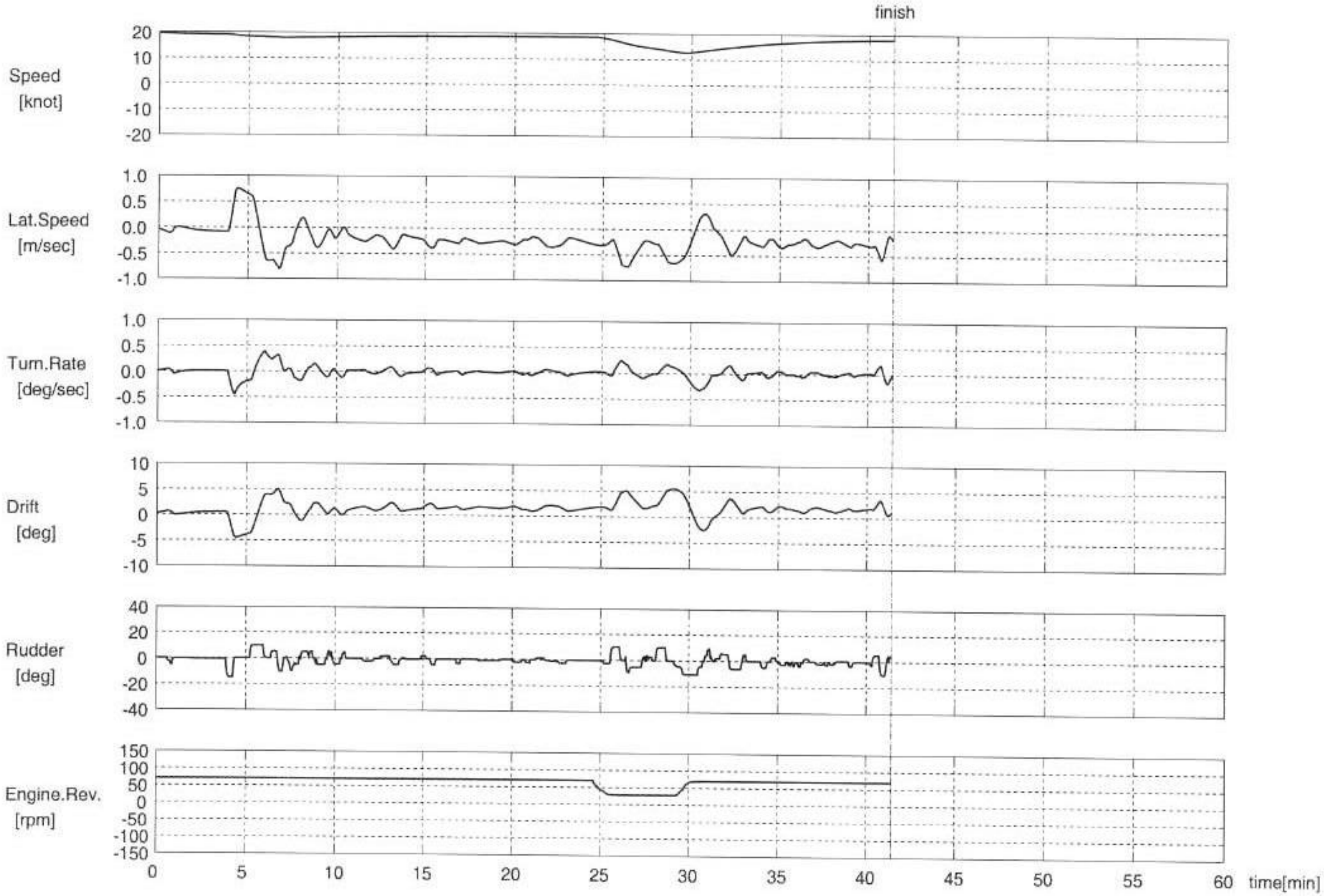
Code	Year	Draft	Channel	Bound	Tidal Current	Wind	TSS
Code 17	2020	20.5m	East	North	South 1.25 knots	ESE 5m/sec	Case I

Figure 8.2.43. TRAJECTORY OF MANEUVER (CODE 18)



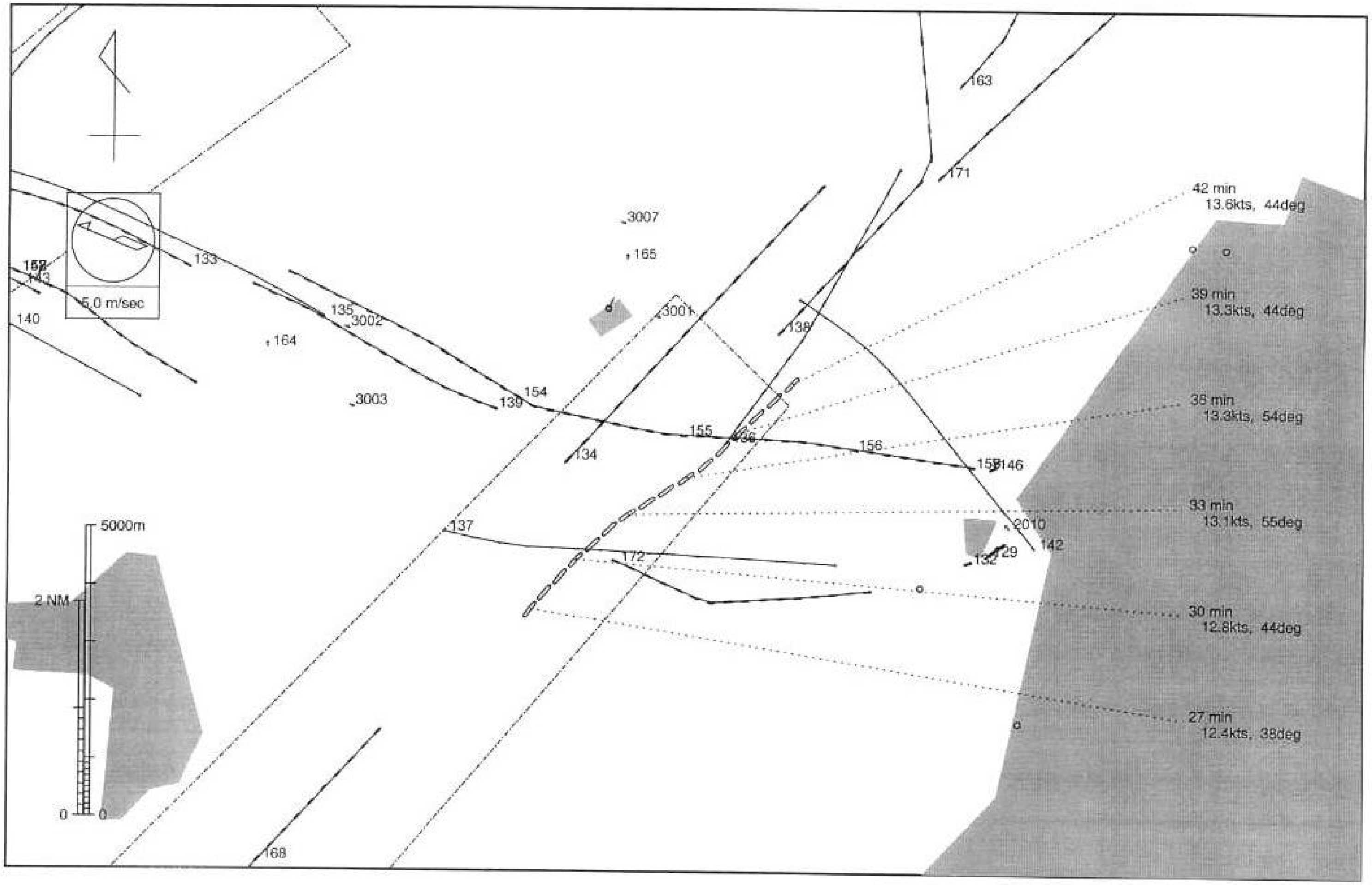
Code	Year	Draft	Channel	Bound	Tidal Current	Wind	TSS
Code 18	2020	10.5m	East	South	South 1.25 knots	ESE 5m/sec	Case I

Figure 8.2.44. TIME HISTORY OF MANEUVERING (CODE 18)



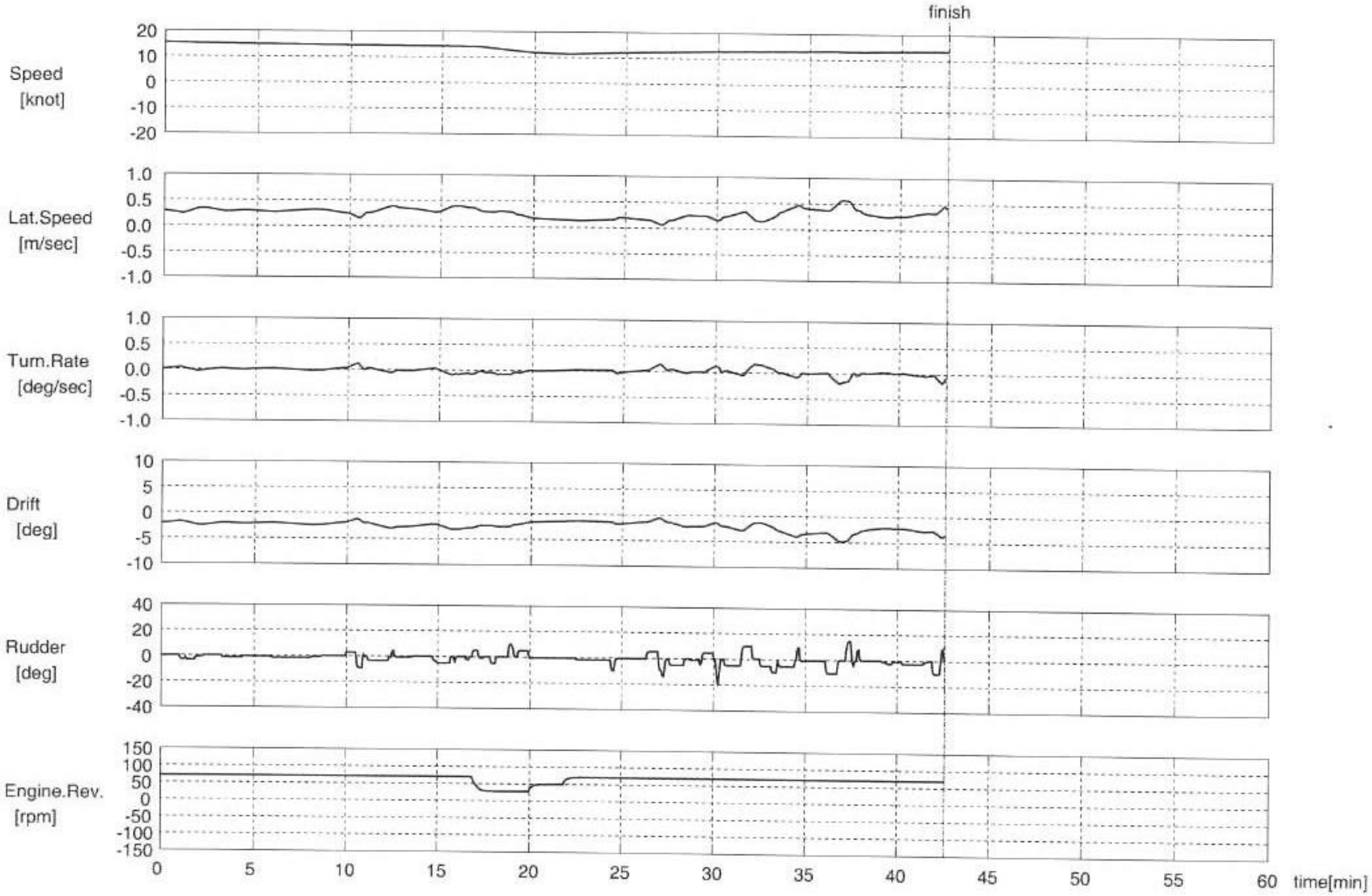
Code	Year	Draft	Channel	Bound	Tidal Current	Wind	TSS
Code 18	2020	10.5m	East	South	South 1.25 knots	ESE 5m/sec	Case I

Figure 8.2.45. TRAJECTORY OF MANEUVER (CODE 19)



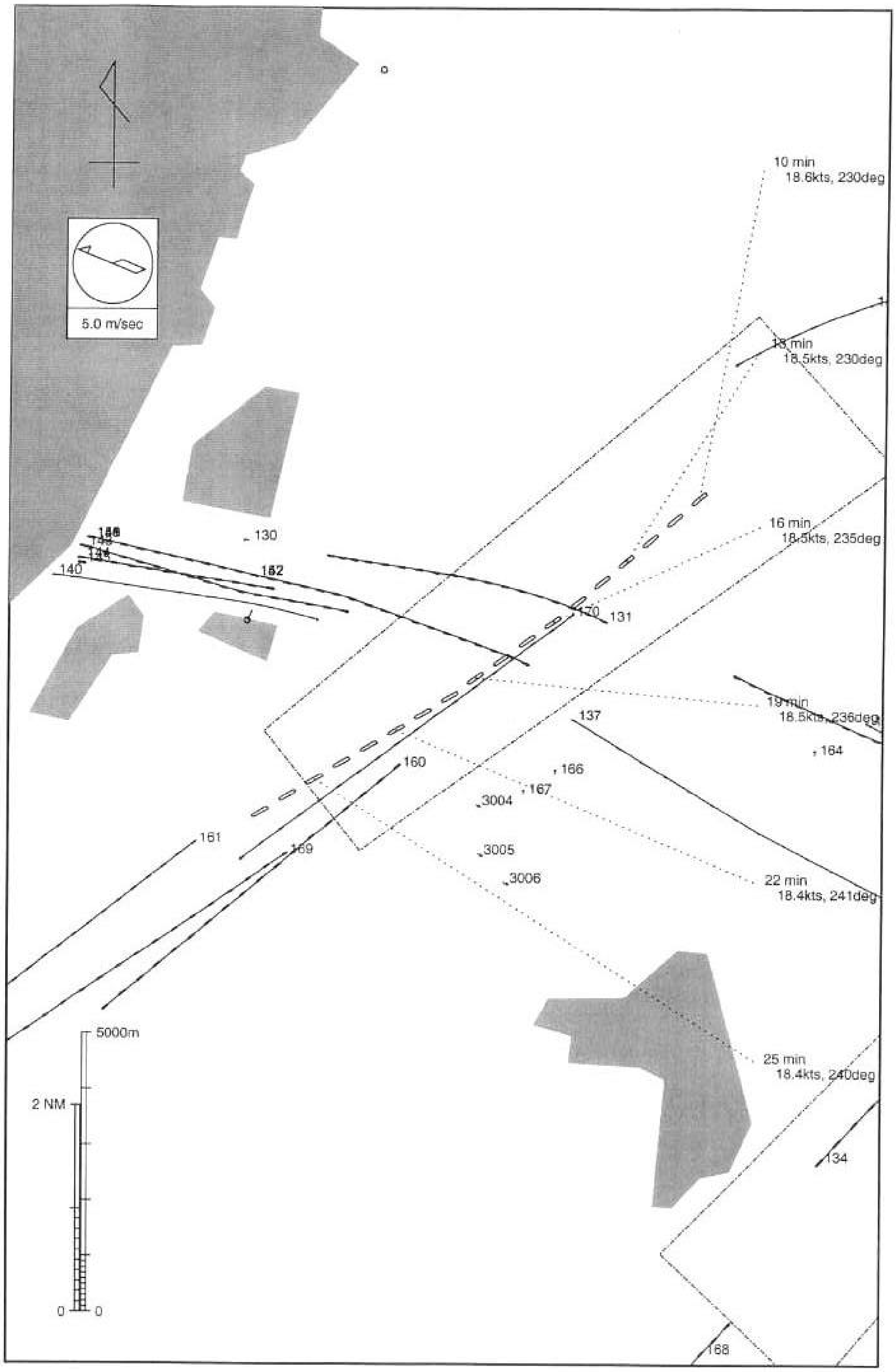
Code	Year	Draft	Channel	Bound	Tidal Current	Wind	TSS
Code 19	2020	20.5m	East	North	South 1.25 knots	ESE 5m/sec	Case II

Figure 8.2.46. TIME HISTORY OF MANEUVERING (CODE 19)



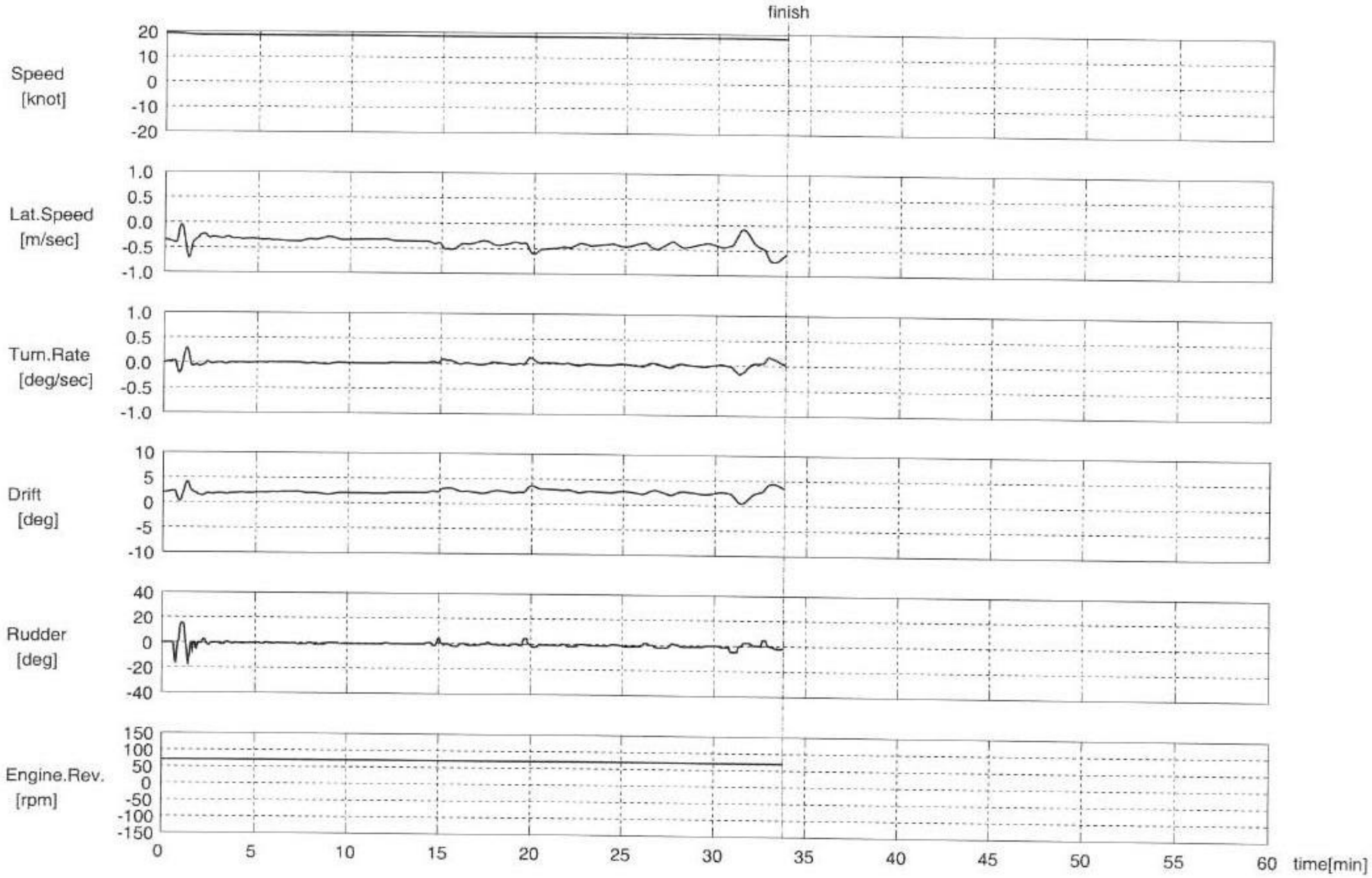
Code	Year	Draft	Channel	Bound	Tidal Current	Wind	TSS
Code 19	2020	20.5m	East	North	South 1.25 knots	ESE 5m/sec	Case II

Figure 8.2.47. TRAJECTORY OF MANEUVER (CODE 20)



Code	Year	Draft	Channel	Bound	Tidal Current	Wind	TSS
Code 20	2020	10.5m	West	South	South 1.25 knots	ESE 5m/sec	Case II

Figure 8.2.48. TIME HISTORY OF MANEUVERING (CODE 20)



Code	Year	Draft	Channel	Bound	Tidal Current	Wind	TSS
Code 20	2020	10.5m	West	South	South 1.25 knots	ESE 5m/sec	Case II

(3) Rating by Captains of Stage-2

Rating by the captain's observation on the scene had implemented through questionnaire. The questionnaire is shown in **Figure 8.2.49.**

Figure 8.2.49. Questionnaire

QUESTIONNAIRE

NAME Capt. ______________________ **COMPANY** ______

Please fill up your opinion in accordance with the undermentioned query.

1. How do you think if we plan to pass for the VLCC (280,000 D/W) at the SELAT SUNDA without economical matters..

   a. no risk　　b. even　　c. low risk　　d. high risk

2. Do you feel what kind of risk ?

   a. collision　　b. aground　　c. other ____________

3. Do you have any idea in order to decrease the above risk.

   a. TSS　　b. VTIS　　c. Daylight Passing　　d. other ______

4. If we plan to set the TSS, where is the best location ? (Without TSS)

   a. both side of the P. SANGIANG island

   b. between the P. SANGIANG island and the JAWA island

   c. both side of the TERUMBKU KOLIOT

5. How do you think about this location of TSS ? (With TSS)

6. Your comment for safety passage (Free)

The summary of questionnaires

Query 1. How do you think if we plan to pass for the VLCC (280,000D/W) at the SELAT SUNDA without economical matters?

	Code No.	a. no risk	b. even	c. low risk	d. high risk
present	1	0	3	6	1
	2				
	3				
	4				
2007	5	1	4	4	0
	6	2	5	2	0
	7	2	5	2	0
	8	0	3	6	0
	9	0	3	5	1
	10	0	3	4	1
	11	0	5	2	1
	12	0	5	2	1
Sub Total		5	33	27	4
2020	13	0	2	2	3
	14	0	2	2	3
	15	0	3	5	0
	16	0	3	5	0
	17	0	2	3	2
	18	0	3	4	1
	19	1	4	3	0
	20	1	7	0	0
Sub Total		2	26	24	9
Grand Total		7	62	57	14

Query 2. Do you feel what kind of risk ?

	Code No.	a. collision	b. aground	c. other
present	1	9	5	0
	2			
	3			
	4			
2007	5	7	1	1
	6	6	1	1
	7	6	3	1
	8	9	4	0
	9	7	4	0
	10	7	2	1
	11	7	3	0
	12	7	1	0
Sub Total		56	19	4
2020	13	6	4	0
	14	7	2	0
	15	7	4	0
	16	7	4	0
	17	7	5	0
	18	8	2	0
	19	8	4	0
	20	6	2	1
Sub Total		56	27	1
Grand Total		121	51	5

Query 3. Do you have any idea in order to decrease the above risk ?

	Code No.	a. TSS	b. VTIS	c. Daylight Passing	d. other
present	1	9	0	2	1
	2				
	3				
	4				
2007	5	6	1	1	0
	6	5	1	1	0
	7	6	1	1	0
	8	8	1	1	0
	9	4	4	2	0
	10	4	3	1	0
	11	5	3	0	0
	12	6	3	0	0
Sub Total		44	17	7	0
2020	13	6	1	1	0
	14	7	1	2	0
	15	7	0	2	0
	16	7	0	2	0
	17	5	3	2	0
	18	6	3	1	1
	19	7	3	0	0
	20	4	3	0	0
Sub Total		49	14	10	1
Grand Total		102	31	19	2

Query 4. If we plan to set the TSS, where is the best location ?

	Code No.	a. both side of the P.SANGIANG island (TSS-Case Ⅱ)	b. between the P.SANGIANG island and the JAWA island (TSS-Case Ⅰ)	c. both side of the TERUMBKU KOLIOT
present	1	9	0	1
	2			
	3			
	4			
2007	5	7	1	0
	6	6	1	0
	7	8	1	0
	8	8	1	0
	9	1	1	0
	10	0	1	0
	11	0	0	0
	12	0	0	0
Sub Total		30	6	0
2020	13	7	0	0
	14	8	0	0
	15	8	0	0
	16	8	0	0
	17	4	0	0
	18	4	0	0
	19	3	0	0
	20	4	0	0
Sub Total		46	0	0
Grand Total		85	6	1

Query 5.1 If you mind many fishing boats at South of the SANGIANG Island, how do you feel for passing at 4.(b) with safely ?

present	• Difficult • If meeting situation occurs and many fishing boats at this area, serious risk (collision and grounding) shall appear. • Especially for northbound vessels, increase risk of grounding due to avoid fishing boats. Recommend TSS at both sides of Sangiang islands. • Passing with care. In case of squall and night time, S/B eng. and increase look out shall be considered. • If fishing boats stop or move slowly, feel not so danger. • I will change her co. to pass west side of Sangiang Island when northbound.

Query 5.2 How do you think this location of TSS? (with TSS)

2007 and 2020	• TSS-1 is better. • Recommend above item 4-a (both side of the P.SANGIANG). • There was not enough room for loaded VLCC in case large course alterations are requested to avoid crossing ferry. • To avoid crossing vessels, I feel the width of TSS is not enough. • Good. • Enough room for VLCC(Ballast) at Daytime. • Since there is not difficulty of this space, this TSS is preferable and this location of TSS is better. • No necessity for single way due to few traffic. • Width of TSS is rather small. • It is better to provide the separation zone between separation lanes. • No good. Best location is (a). • Proper lane width is from 1and 1/4 to 1 and 1/2.

Query 6 Your comment for safety passage (Free)

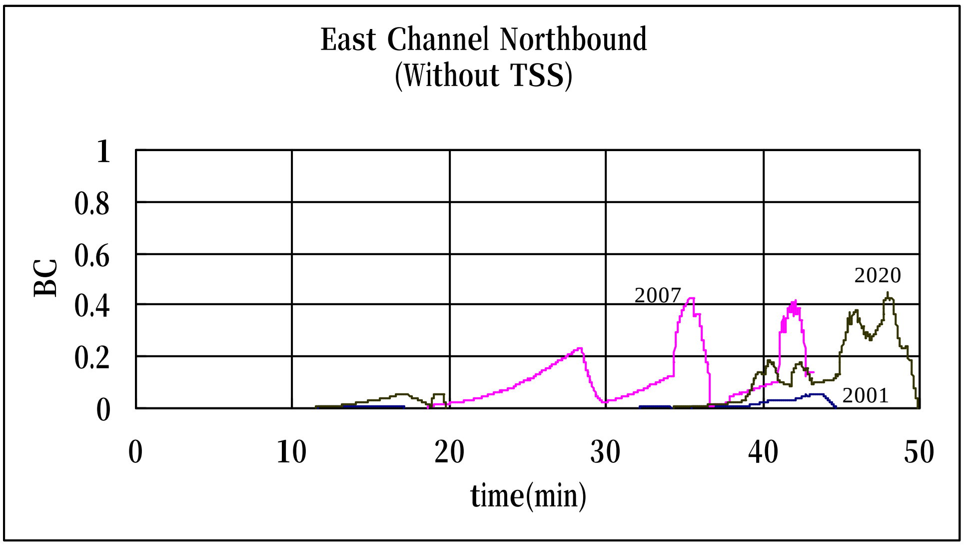
2007 and 2020	• Safety avoiding area for crossing ferry must be considered for passage plan. • Sea speed under S/B eng. is necessary. • Set watch level 2 or 3. • Must keep S/B full speed (12.0 k't). • The necessity and effect of TSS is not understood well. • The width of traffic lane seems to be reasonable. • The width of traffic lane is not enough. • Necessary to use engine motion when passing between Fempuruing & Merak. • Daylight operation is prefered. • Some system to inform crossing ferry to keep clear of large vessels in TSS. • In case there are many crossing vessels, it may be very dangerous. • To avoid other vessels by altering the course, a sufficient room is necessary. • Safety passing is through Sunda strait. • It is not realistic to separate completely the traffic in single way. • It is better that North Bound lane & South bound lane have a separate area.

(4) Rating by Blocking Coefficients of Avoiding Action of Stage-2

a) East channel Northbound

Rating by blocking coefficients is shown in **Figure 8.2.50.**

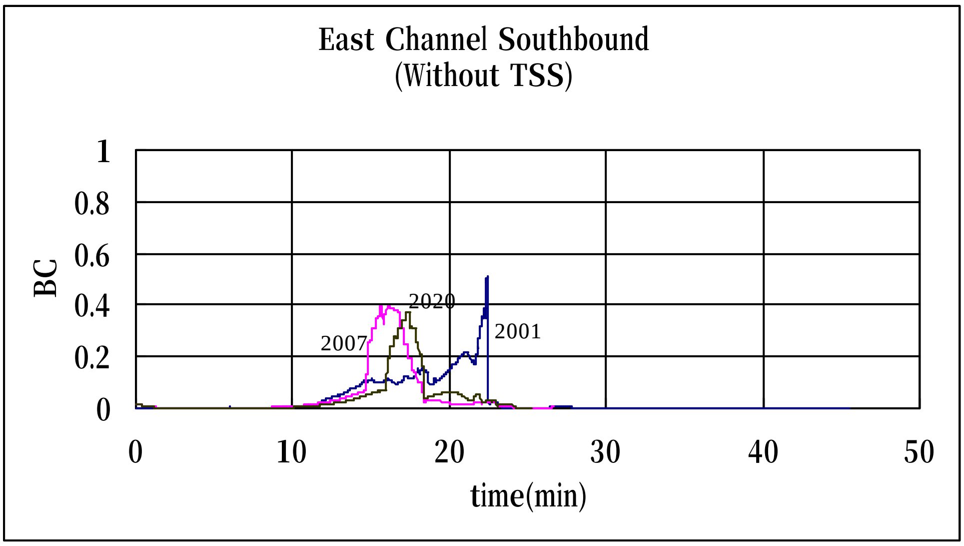
Figure 8.2.50. East channel Northbound



b) East channel Southbound

Rating by blocking coefficients is shown in **Figure 8.2.51.**

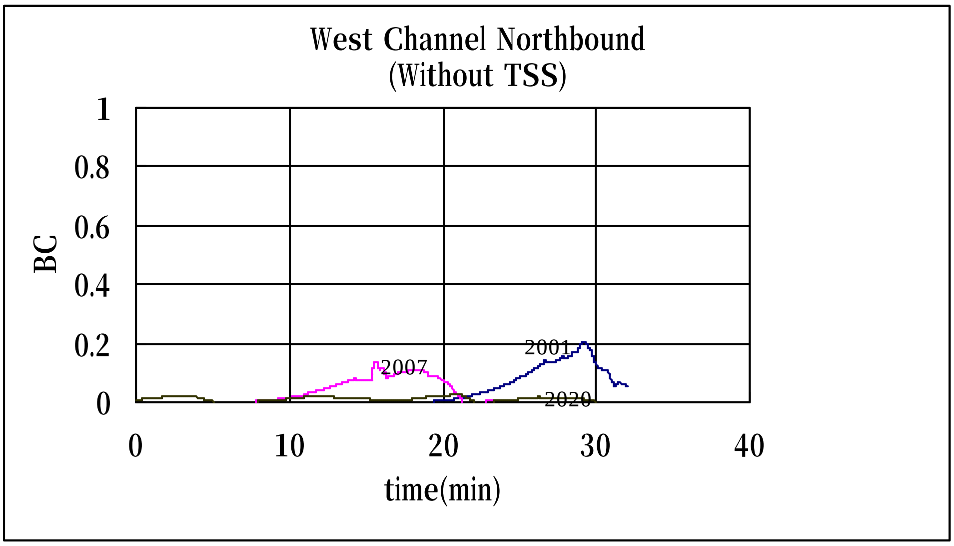
Figure 8.2.51. East channel Southbound



c) West channel Northbound

Rating by blocking coefficients is shown in **Figure 8.2.52.**

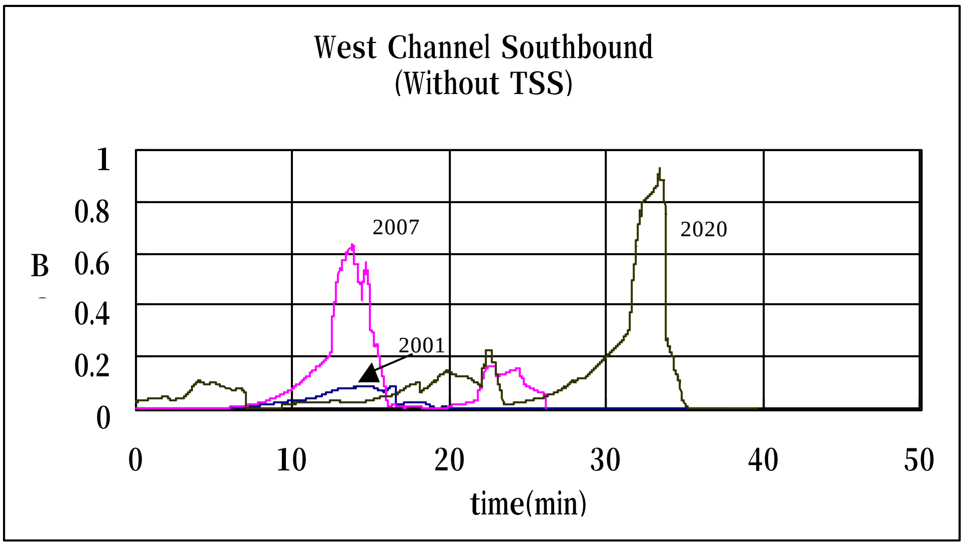
Figure 8.2.52. West channel Northbound



d) West channel Southbound

Rating by blocking coefficients is shown in **Figure 8.2.53.**

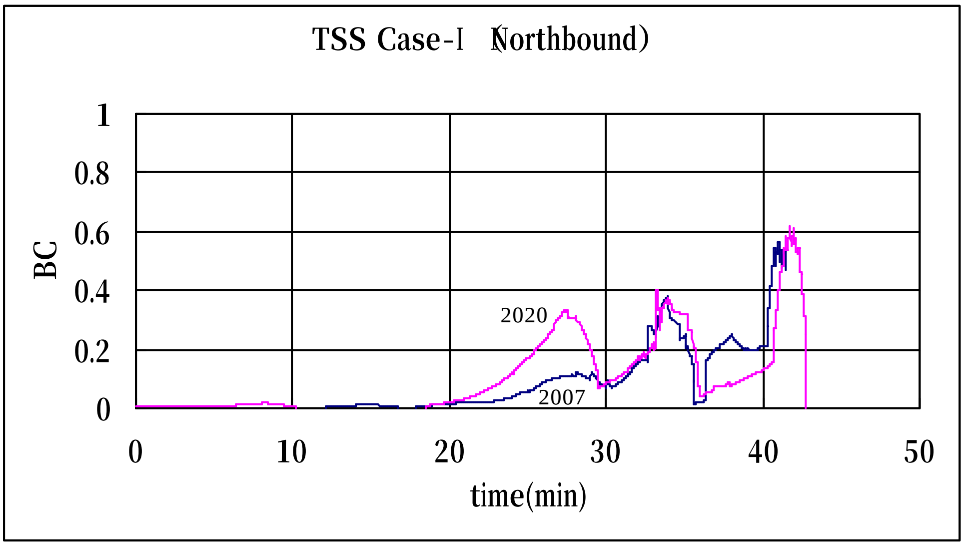
Figure 8.2.53. West channel Southbound



e) TSS-Ⅰ North bound

Rating by blocking coefficients is shown in **Figure 8.2.54.**

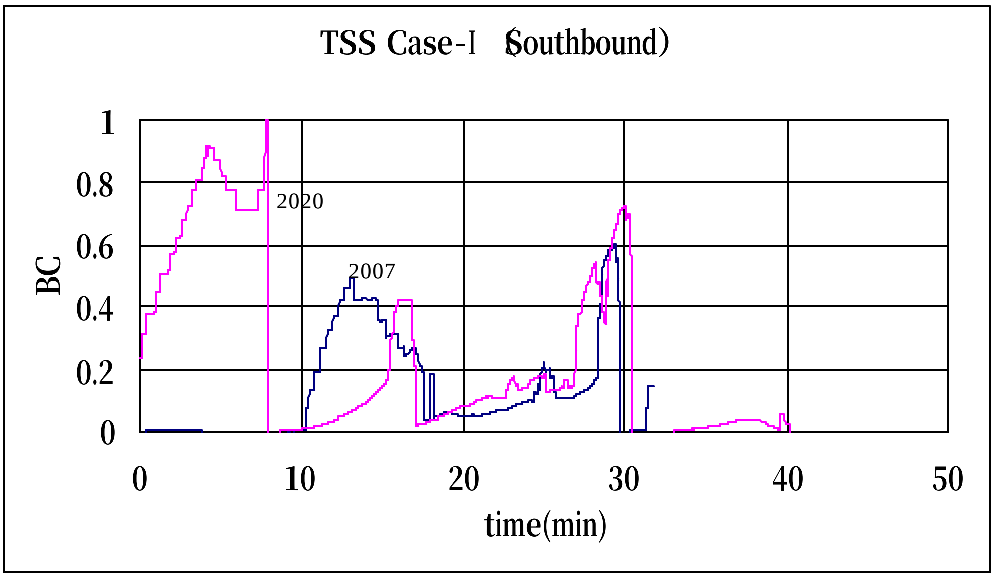
Figure 8.2.54. TSS-Ⅰ Northbound



f) TSS-Ⅰ Southbound

Rating by blocking coefficients is shown in **Figure 8.2.55.**

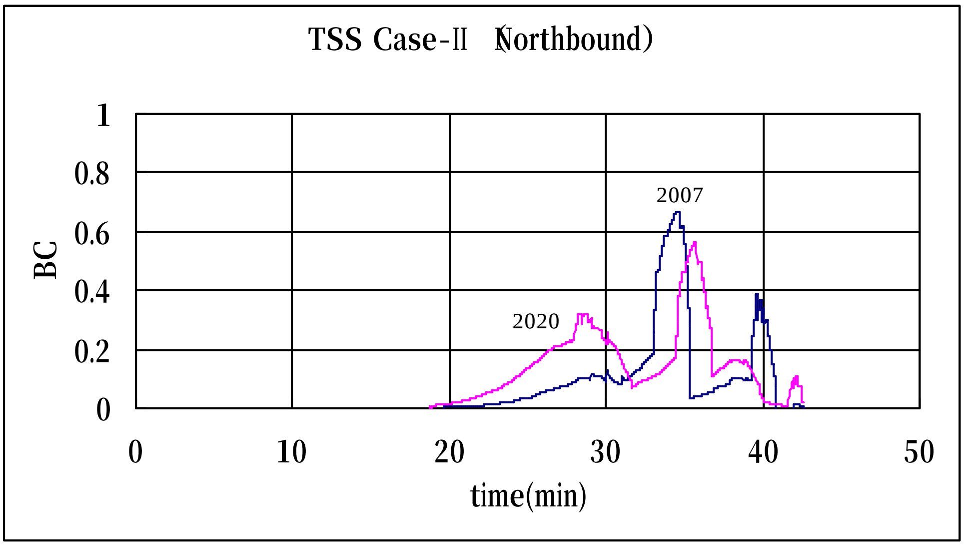
Figure 8.2.55. TSS-Ⅰ Southbound



g) TSS-II Northbound

Rating by blocking coefficients is shown in **Figure 8.2.56.**

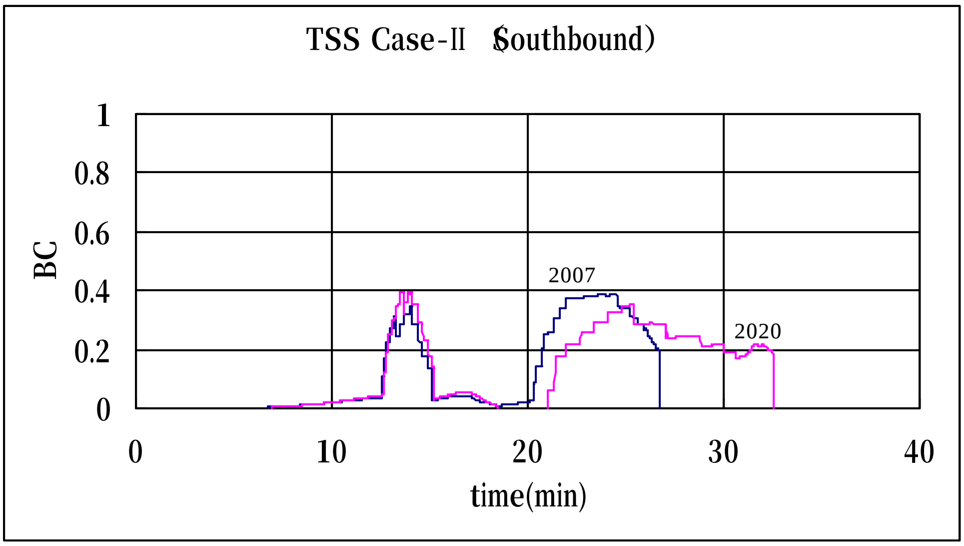
Figure 8.2.56. TSS-II Northbound



h) TSS-II Southbound

Rating by blocking coefficients is shown in **Figure 8.2.57.**

Figure 8.2.57. TSS-II Southbound



8.2.8. 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 increased on it in 2020.

② Most captains suggested that the provision 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 ferry and fishing boat engaged in fishing.

④ Almost captains suggested that TSS would be located at the both side of the P.SANGIANG Island. Furthermore, the Case II was better than Case I.

(2) Rating by Blocking Coefficients of Avoiding Action

① Maximum blocking coefficients without TSS, 0.5 in 2001, 0.6 in 2007, 0.9 in 2020, is getting worse as the years go by.

② Maximum blocking coefficients of case Ⅰ, 0.6 in 2007 0.9 in 2020, is getting worse as the years go by.

③ Maximum blocking coefficients of caseⅡ, 0.65 in 2007, 0.55 in 2020.

Table 8.2.7. Summary of Simulation Cases

Code	Year	Channel	Bound	TSS	Summary
01	2001	East	North	Nil	Blocking coefficients is below 0.1.
02	2001	East	South	Nil	Max. blocking coefficients is 0.5. The duration of 0.5 is less than 1 minute.
03	2001	West	North	Nil	Max. blocking coefficients is 0.2.
04	2001	West	South	Nil	Max. blocking coefficients is 0.1
05	2007	East	North	Nil	Max. blocking coefficients is 0.4.
06	2007	East	South	Nil	Max. blocking coefficients is 0.4.
07	2007	West	North	Nil	Max. blocking coefficients is 0.1.
08	2007	West	South	Nil	Max. blocking coefficients is 0.6. Captain alter course due to avoiding crossing ferry.
09	2007	East	North	Case I	Max. blocking coefficients is 0.6. Captain alter course due to avoiding crossing ferry.
10	2007	East	South	Case I	Max. blocking coefficients is 0.6. The duration of 0.6 is about 1 minute. Captain does not seem to feel burden.
11	2007	East	North	Case II	Max. blocking coefficients is 0.65. The duration of 0.65 is about 1 or 2 minutes. Captain does not seem to feel burden. A danger of collision is high.
12	2007	West	South	Case II	Max. blocking coefficients is 0.4.
13	2020	East	North	Nil	Max. blocking coefficients is 0.4.
14	2020	East	South	Nil	Max. blocking coefficients is 0.4.
15	2020	West	North	Nil	Max. blocking coefficients is below 0.1.
16	2020	West	South	Nil	Max. blocking coefficients is 0.9. The duration of 0.9 is 2 minutes. A danger of collision is high.
17	2020	East	North	Case I	Max. blocking coefficients is 0.6. The duration of 0.6 is 1 minute. Captain does not seem to feel burden.
18	2020	East	South	Case I	Max. blocking coefficients is 0.9. The duration of 0.9 is in a moment. This situation happened before entering TSS among same way ship and meeting ships. A danger of collision is high.
19	2020	East	North	Case II	Max. blocking coefficients is 0.55. The duration of 0.55 is in a moments.
20	2020	West	South	Case II	Max. blocking coefficients is 0.35.

(3) Overall Rating

According to above rating by captains and by the blocking coefficients of avoiding action, followings are described.

- Case II have advantage on the point of blocking coefficients.
- Case I ,II have no meeting ships at TSS due to the organization of traffic flows.
- The width of TSS in case I is not enough to avoid crossing ferry.
- On the point of captain of crossing ferry, case II is easy to maneuver due to the organization of traffic flow.
- Inshore Traffic is needed for ships of less than 20 meters in length, sailing ships and fishing boats. Also a ship use Inshore Traffic when route to or from a port, offshore installation or structure, pilot station or any other place situated within the Inshore Traffic, or to avoid immediate danger. For that purpose, the study team judges that enough space should be needed for inshore traffic.

It is proved by this experiments that the early provision of TSS is necessary as a safety measure to avoid collision with many crossing vessels and fishing boats, and aground at such narrow water. Moreover, it is judged to provide also VTIS in the future.

It is suggested that the Case II of TSS is effective as one way traffic at both east and west sides of Sangiang Island, and the width of TSS needs at least 1 and 1/4 nautical miles due to secure Inshore Traffic.

Proposed TSS is shown **in Figure 8.2.58**.

Figure 8.2.58. Proposed TSS in Sunda Strait

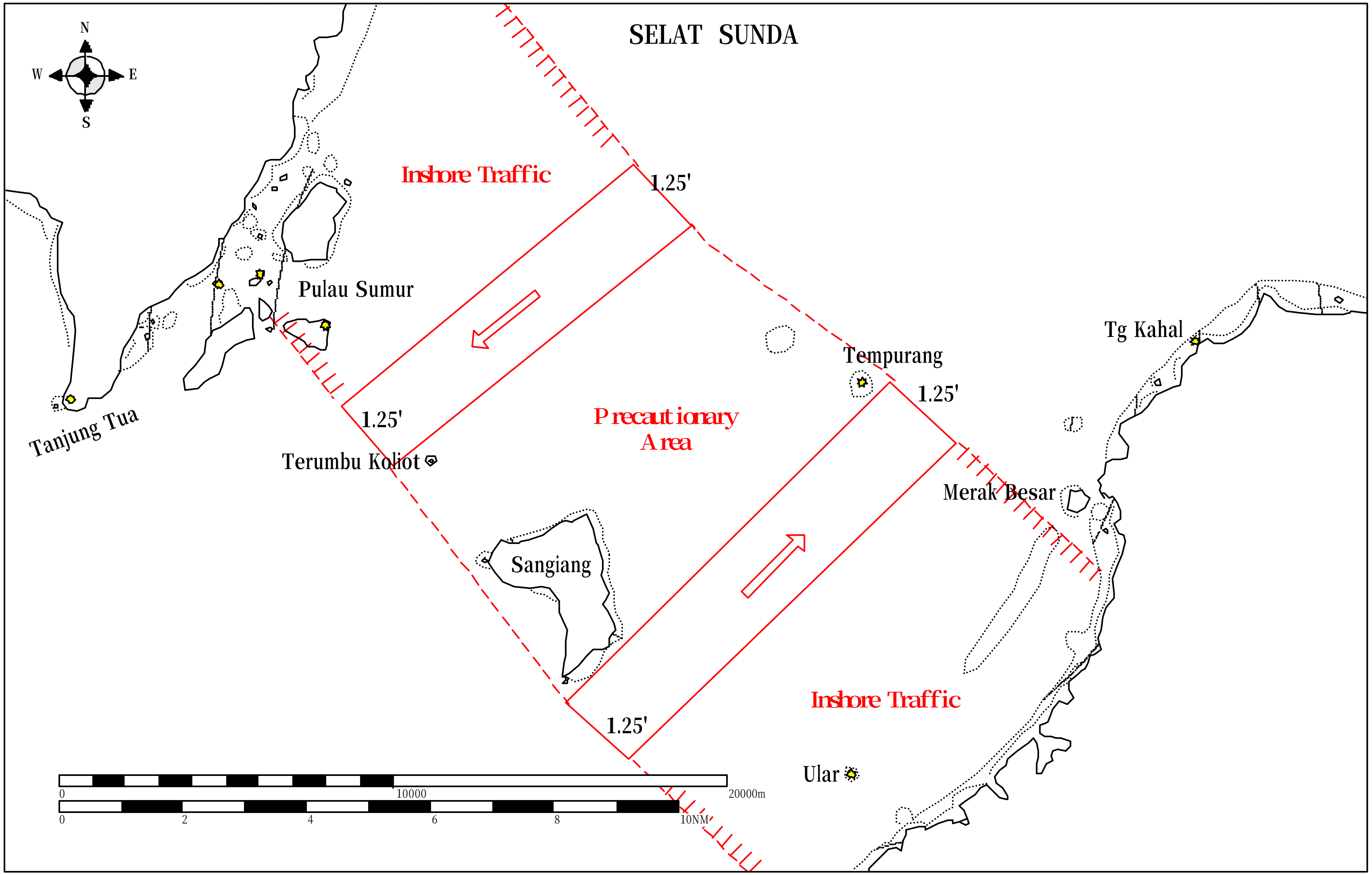


Figure 8.2.58 Proposed TSS

INTERNATIONAL MARITIME ORGANIZATION

IMO

ASSEMBLY
21st session
Agenda item 5

A 21/Res.884
4 February 2000
Original: ENGLISH

RESOLUTION A.884(21)
adopted on 25 November 1999

AMENDMENTS TO THE CODE FOR THE INVESTIGATION OF MARINE CASUALTIES AND INCIDENTS (RESOLUTION A.849(20))

THE ASSEMBLY,

RECALLING Article 15(j) of the Convention on the International Maritime Organization concerning the functions of the Assembly in relation to regulations and guidelines concerning maritime safety and the prevention and control of marine pollution from ships,

RECALLING ALSO resolution A.849(20) by which it adopted the Code for the Investigation of Marine Casualties and Incidents,

CONSIDERING that practical advice for the systematic investigation of human factors in marine casualties and incidents will assist an effective analysis and promote the identification and implementation of preventive action,

RECOGNIZING the need for development and use, as appropriate, of practical guidelines for the investigation of human factors in marine casualties and incidents,

HAVING CONSIDERED the recommendations made by the Maritime Safety Committee at its seventy-first session and by the Marine Environment Protection Committee at its forty-third session,

1. ADOPTS amendments to the Code for the Investigation of Marine Casualties and Incidents incorporating the Guidelines for the Investigation of Human Factors in Marine Casualties and Incidents, as set out in the Annex to the present resolution;

2. INVITES Governments to implement the Guidelines as soon as practicable, as far as national law allows, with a view to improving the quality and completeness of casualty investigations and reports;

3. REQUESTS the Maritime Safety Committee and the Marine Environment Protection Committee to keep the Guidelines under review and to amend them as necessary.

ANNEX

AMENDMENTS TO THE CODE FOR THE INVESTIGATION OF MARINE CASUALTIES AND INCIDENTS (RESOLUTION A.849(20))

1 The existing appendix is renumbered as appendix 1.

2 A new appendix 2 is added as follows:

"APPENDIX 2

GUIDELINES FOR THE INVESTIGATION OF HUMAN FACTORS IN MARINE CASUALTIES AND INCIDENTS

CONTENTS

APPENDICES

1 INTRODUCTION - PURPOSE OF THE GUIDELINES

1.1 The purpose of these Guidelines is to provide practical advice for the systematic investigation of human factors in marine casualties and incidents and to allow the development of effective analysis and preventive action. The long-term intent is to prevent similar casualties and incidents in the future[1].

1.2 Ships operate in a highly dynamic environment; frequently the people on board follow a set routine of shift work disrupted by arrival at, working in, and sailing from port. This is an existence which involves living in the place of work for prolonged periods, creating a unique form of working life which almost certainly increases the risk of human error.

1.3 Historically, the international maritime community has approached maritime safety from a predominantly technical perspective. The conventional wisdom has been to apply engineering and technological solutions to promote safety and to minimize the consequences of marine casualties and incidents. Accordingly, safety standards have primarily addressed ship design and equipment requirements. Despite these technical innovations, significant marine casualties and incidents have continued to occur.

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1 For the purpose of these Guidelines, the term "marine casualties and incidents" includes occupational accidents resulting in loss of life or serious personal injury.

1.4 Analyses of marine casualties and incidents that have occurred over the past 30 years have prompted the international maritime community, and the various safety regimes concerned, to evolve from an approach which focuses on technical requirements for ship design and equipment to one which seeks to recognize and more fully address the role of human factors in maritime safety within the entire marine industry. These general analyses have indicated that given the involvement of the human in all aspects of marine endeavours, including design, manufacture, management, operations and maintenance, almost all marine casualties and incidents involve human factors.

1.5 One way the maritime community has sought to address the contribution of the human factor to marine casualties and incidents has been to emphasize the proper training and certification of ships' crews. It has become increasingly clear, however, that training is only one aspect of the human factor. There are other factors which contribute to marine casualties and incidents which must be understood, investigated and addressed. The following are examples of these factors relevant to the maritime industry: communication, competence, culture, experience, fatigue, health, situational awareness, stress and working conditions.

1.6 Human factors which contribute to marine casualties and incidents may be broadly defined as the acts or omissions, intentional or otherwise, which adversely affect the proper functioning of particular system, or the successful performance of a particular task. Understanding human factors thus requires a study and analysis of the design of the equipment, the interaction of the human operator with the equipment, and the procedures followed by crew and management.

1.7 It has been recognized that there is a critical need for guidance for accident investigators which will help them to identify specific human factors which have contributed to marine casualties and incidents. There is also a need to provide practical information on techniques and procedures for the systematic collection and analysis of information on human factors during investigations. These Guidelines seek to fulfil those needs. They include a list of topics which should be considered by investigators, and procedures for recording and reporting the results.

1.8 These Guidelines should result in an increased awareness by all involved in the marine industry of the role human factors play in marine casualties and incidents. This awareness should lead to proactive measures by the maritime community which in turn should result in the saving of lives, ships, cargo and the protection of the marine environment, improvements to the lives of marine personnel, and more efficient and safer shipping operations.

1.9 These Guidelines apply, as far as national laws allow, to the investigation of marine casualties or incidents in which either one or more States have a substantial interest because the casualty or incident involves a ship under or within their jurisdiction.

2 INVESTIGATION PROCEDURES AND TECHNIQUES

2.1 A systematic approach

2.1.1 The following is a process that provides a step-by-step systematic approach for use in the investigation of human factors. The process is an integration and adaptation of a number of established human factor frameworks. The process can be applied to any type of marine casualty or incident and consists of the following steps:

.1 collect occurrence data;

.2 determine occurrence sequence;

.3 identify unsafe acts or decisions and unsafe conditions,

and then for each unsafe act or decision,

.4 identify the error type or violation;

.5 identify underlying factors; and

.6 identify potential safety problems and develop safety actions.

This process is detailed in appendix 1.

2.1.2 A systematic approach to step 1 is crucial to ensure that critical information is not overlooked or lost and that a comprehensive analysis can be made.

2.1.3 Step 2 involves organizing the data collected in step 1 to develop a sequence of events and circumstances.

2.1.4 In step 3, the information gathered and organized is used to initiate the identification of occurrence causal factors, i.e., unsafe acts, decisions or conditions. Once an unsafe act, decision or condition has been identified, the next stage is to determine the genesis of that particular act, decision or condition.

2.1.5 Step 4 is initiated in order to specify the type of error or violation involved in each identified unsafe act or decision.

2.1.6 In step 5, the focus is on uncovering the underlying factors behind the unsafe act, decision or condition. Fundamental to the process is the notion that for each underlying factor there may be one or more associated unsafe acts, decisions or conditions. The re-examination of each step of the process may show where further investigation is necessary.

2.1.7 Finally, step 6 requires the identification of potential safety problems and the proposing of safety action based on the identified underlying factors.

2.2 General consideration

An occurrence may result in serious injury, illness, damage or environmental impact and sometimes all four. The purpose of a marine casualty or occurrence safety investigation is to *prevent* recurrence of similar occurrences by identifying and recommending remedial action. All minor occurrences of high potential in terms of credible result should be subjected to a full investigation. Studies have shown that occurrences can have many causal factors and that underlying causes often exist remote from the incident site. Proper identification of such causes requires timely and methodical investigation, going far beyond the immediate evidence and looking for underlying conditions which may cause other future occurrences. Occurrence investigation should therefore be seen as a means of identifying not only immediate causes, but also failures in the total management of the operation from policy through to implementation. For this reason investigations should be broad enough to meet these overriding criteria.

2.2.1 Timing of the investigation

An investigation should be carried out as soon as possible after an occurrence. The quality of evidence, particularly that relying on the accuracy of human recollection, can deteriorate rapidly with time, and delayed investigations are usually not as conclusive as those performed promptly. A prompt investigation is also a good demonstration of commitment by all those concerned.

2.2.2 The occurrence site

Where possible, the site of the occurrence should be left unchanged until the investigation team has inspected it. Where this is not possible, for instance because of the need to make essential and immediate repairs following serious structural damage, the scene should be documented by photographs, audio-visual recordings, sketches or any other relevant means available with the object of preserving vital evidence and possibly recreating the circumstances at a later date. Of particular importance is the recording of the position of individuals at the site, the condition and position of equipment, supervisory instructions, work permits and recording charts. Damage or failed components should be kept in a secure location to await the arrival of the investigation team, who may require detailed scientific examination of certain key objects. Such key objects should ' carefully marked.

2.2.3 Witness information

Once the situation in the immediate aftermath of an occurrence has been stabilised and the threat to people, plant and the environment has been removed, everyone involved should commit their recollections to paper to assist in preserving their memory of events. In the event that local authorities take over responsibility for the investigation, the organisation/company involved should nominate a focal point to liaise with the authorities and to assist them in assembling the information they require. Where necessary, legal assistance should be provided.

2.2.4 Background information

Appropriate background information should be obtained before visiting the occurrence location. Such information might include, but is not necessarily limited to:

- procedures for the type of operation involved;
- records of instructions / briefings given on the particular job being investigated;
- location plans;
- command structure and persons involved;
- messages, directions, etc., given from base/headquarters concerning the work;
- ship particulars and plans; and
- any other relevant information that may enable the investigator to understand the context of the incident.

2.2.5 The investigation sequence

2.2.5.1 The method for fact-finding while conducting an investigation includes, but is not necessarily limited to, the following activities:

- inspecting the location;
- gathering or recording physical evidence;
- interviewing witnesses taking into account cultural and language differences (on-site and external);
- reviewing of documents, procedures and records;
- conducting specialised studies (as required);
- identifying conflicts in evidence;
- identifying missing information; and
- recording additional factors and possible underlying causes.

2.2.5.2 Following the fact-finding a typical marine casualty or incident investigation includes analysis of the facts, conclusions and safety recommendations.

2.2.6 Fact-finding

2.2.6.1 The objective of this stage of the investigation is to collect as many facts as possible which may help understanding of the incident and the events surrounding it. The scope of any investigation can be divided into five areas:

- people;
- environment;
- equipment;
- procedures; and
- organization.

2.2.6.2 Conditions, actions or omissions for each of these may be identified, which could be factors contributing to the incident or to subsequent injury, damage or loss.

2.2.6.3 During the initial stages of every investigation, investigators should aim to gather and record all the facts which may be of interest in determining causes. Investigators should be aware of the danger of reaching conclusions too early, thereby failing to keep an open mind and to consider the full range of possibilities. With this in mind, it is recommended that the fact-finding stage of the investigation process itself be kept separate from the complete analysis of the collected evidence leading to conclusions and recommendations, and that a structured methodology be adopted to ensure the effectiveness of that analysis. The analysis may well help to identify missing pieces of evidence, or different lines of enquiry that may otherwise have gone undetected.

2.2.6.4 Investigation checklists can be very useful in the early stages to keep the full range of enquiry in mind, but they cannot cover all possible aspects of an investigation, neither can they follow all individual leads back to basic causal factors. When checklists are used, their limitations should be clearly understood.

2.2.6.5 The initial stages of an investigation normally focus on conditions and activities close to the incident and only primary causes, also called "active failures", are usually identified at this stage. However, conditions or circumstances underlying these causes, also called "latent failures", should also be investigated.

2.2.6.6 A factor to consider during an investigation is recent change. In many cases it has been found that some change occurred prior to an occurrence which, combining with other causal factors already present, served to initiate the occurrence. Changes in personnel, organisation, procedures, processes, and equipment should be investigated, particularly the hand-over of control and instructions, and the communication of information about the change to those who needed to know.

2.2.6.7 The effect of work cycles and work-related stress could have an impact on an individual's performance prior to an occurrence. The impact of social and domestic pressures (so-call error-enforcing conditions) related to an individual's behaviour should not be overlooked.

2.2.6.8 Information should be verified wherever possible. Statements made by different witnesses may conflict and further supporting evidence may be needed. To ensure that all the facts are uncovered, the broad questions of "who?, what?, when?, where?, why?, and how?" should be asked.

2.2.7 Conducting interviews

2.2.7.1 An interview should start with the introduction of the interviewing party, the purpose of the investigation and of the interview, and the possible future use to be made of the knowledge and material obtained during the interview. Investigators should be guided by the requirements of national law regarding the presence of legal advisers or other third parties during an interview.

2.2.7.2 People should be interviewed singly and be asked to go step-by-step through the events surrounding the occurrence, describing both their own actions and the actions of others. The interviewer should take into account the culture and language of the interviewee.

2.2.7.3 Notwithstanding any previously made written statements, the value of a witness's stateme can be greatly influenced by the style of the interviewer, whose main task is to listen to the witness's story and not to influence him/her.

2.2.7.4 If the investigation is a team effort, great care should be taken not to make a witness feel intimidated by too many interviewers. Experience has shown that interviews can be effectively conducted by two interviewers and if appropriate, the witness could be accompanied by an independent "friend".

2.2.7.5 It should be remembered that an investigation team is often seen as having a prosecuting role, and there may be reluctance to talk freely if interviewees think they may incriminate themselves or their colleagues. An investigator is not in the position to give immunity in return for evidence, but should try to convince interviewees of the purpose of the investigation and of the need for frankness.

2.2.7.6 In addition to requiring both patience and understanding, successful interviewing requires the existence of a "no-blame" atmosphere in which the witness can be made to feel comfortable and is encouraged to tell the truth. It is not the role of the interviewer, or indeed the investigation team, to apportion blame. Their role is to establish the facts and to establish why the occurrence happened.

2.2.7.7 At the end of an interview the discussion should be summarised to make sure that no misunderstandings exist. A written record may be made of the interview and this may be discussed with the witness to clarify any anomalies. Subject to any national law, it may be possible to provide the interviewee with a copy of the written record.

2.2.8 Selection of interviewees

Established marine casualty and incident investigation procedures should be taken into account when determining whom to interview following a marine casualty. Safety concerns should be paramount in the scheduling of interviews.

The aim should always be to get the investigation team to the site of the occurrence as soon as possible and to interview those most closely involved, which in the marine sense will always be the ship first. When that is not possible due to external factors such as the geographical location of the occurrence or political considerations, it may be possible to nominate a local representative to carry out an interim investigation. From an investigation management point of view, it should be possible to start the process by carrying out at least some interviews of individuals ashore.

It may not be possible to speak directly with port or pilotage authorities in some parts of the world. Where that is so, every effort should be made to obtain at least a transcript of the pilot's statement if one is involved. In the event of a collision in enclosed waters, evidence from the operators of shore-based electronic surveillance equipment can be particularly useful.

There are no "hard and fast" rules for selecting whom to interview, and the following is offered as an example only:

2.2.8.1 On site (those nearest the incident)

Generally it is beneficial to begin the interview process with the ship management team, including the master and chief engineer, who typically can provide an overview of the occurrence.

- First-hand witnesses present at the occurrence site at the time of the occurrence itself, regardless of rank/position in the organization.

- First-hand witnesses present at the occurrence site at the time of the occurrence itself, but from outside the organization, for instance berthing or mooring assistants, or visiting personnel such as agents or contractors.

- First-hand witnesses present at the time of the occurrence but not at the occurrence location itself, for instance ship's staff on the bridge of a ship witnessing a mooring occurrence on the main deck below.

- First-hand witnesses present at the time of the occurrence but not at the occurrence location itself and from outside the organization, for instance a pilot on the bridge witnessing a mooring occurrence on the main deck below.

- Those not involved with the occurrence itself but involved in the immediate aftermath of an occurrence, for instance those engaged in damage control, shipboard fire-fighting or first-aid medical treatment.

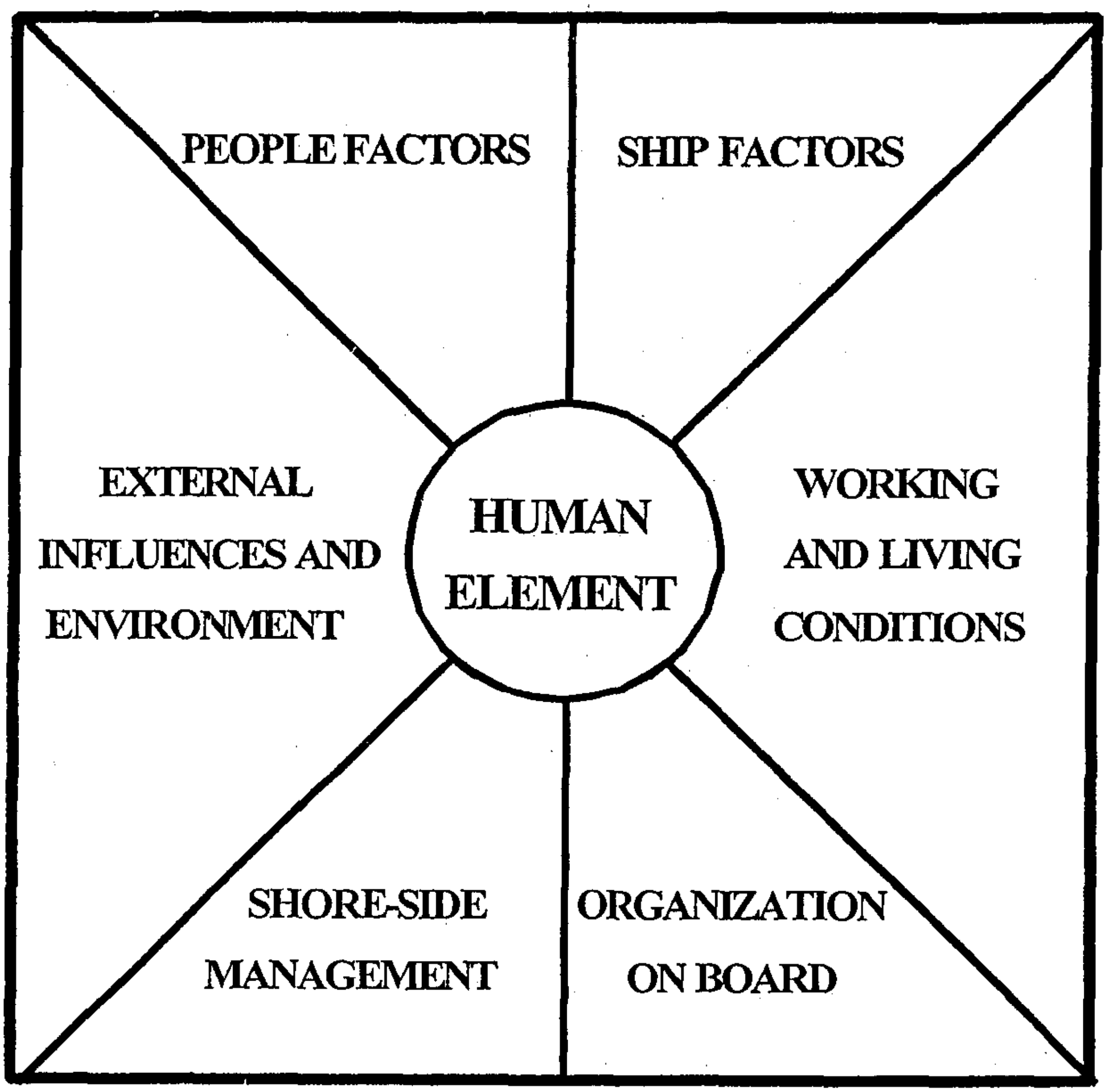
- Tug, mooring boat or pilot cutter crews.
- Search and rescue personnel including helicopter crews.
- Shore-based fire-fighters.
- Jetty/terminal staff.
- Other vessels in the immediate vicinity.
- Operators of Vessel Traffic Services (VTS) or monitoring systems.

2.2.8.2 Remote from occurrence site

- Designated person under the ISM Code.
- Ship operators ashore.
- Technical superintendents ashore.
- Company general managers ashore.
- Specialists/consultants (relevant to the occurrence).
- Port State inspectors.
- Flag State inspectors.
- Regulatory authorities.
- Representatives of classification societies.
- Safety committee members including crew representatives.
- Designers, shipbuilders, manufacturers and repairers.

2.3 Topics to be covered by the investigator[2]

The diagram below shows a number of factors that have a direct or indirect impact on human behaviour and the potential to perform tasks.



The headings in the diagram are expanded below:

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2 Appendix 2 provides appropriate areas of inquiry and Appendix 3 provides definitions of common human element terms.

2.3.1 People factors

- ability, skills, knowledge (outcome of training and experience)
- personality (mental condition, emotional state)
- physical condition (medical fitness, drugs and alcohol, fatigue)
- activities prior to accident/occurrence
- assigned duties at time of accident/occurrence
- actual behaviour at time of accident/occurrence
- attitude

2.3.2 Organization on board

- division of tasks and responsibilities
- composition of the crew (nationality/competence)
- manning level
- workload/complexity of tasks
- working hours/rest hours
- procedures and standing orders
- communication (internal and external)
- on-board management and supervision
- organization of on-board training and drills
- teamwork, including resource management
- planning (voyages, cargo, maintenance)

2.3.3 Working and living conditions

- level of automation
- ergonomic design of working, living and recreation areas and equipment
- adequacy of living conditions
- opportunities for recreation

- adequacy of food
- level of ship motion, vibrations, heat and noise

2.3.4 Ship factors

- design
- state of maintenance
- equipment (availability, reliability)
- cargo characteristics, including securing, handling and care
- certificates

2.3.5 Shore-side management

- policy on recruitment
- safety policy and philosophy (culture, attitude and trust)
- management commitment to safety
- scheduling of leave periods
- general management policy
- port scheduling
- contractual and/or industrial arrangements and agreements
- assignment of duties
- ship-shore communication

2.3.6 External influences and environment

- weather and sea conditions
- port and transit conditions (VTS, pilots, etc)
- traffic density
- ice conditions
- organizations representing shipowners and seafarers
- regulations, surveys and inspections (international, national, port, classification societies, etc.)

2.4 Analysis

Once facts are collected, they need to be analysed to help establish the sequence of events in the occurrence, and to draw conclusions about safety deficiencies uncovered by the investigation. Analysis is a disciplined activity that employs logic and reasoning to build a bridge between the factual information and the conclusions.

The first step in analysis is to review the factual information to clarify what is relevant and what is not, and to ensure the information is complete. This process can give guidance to the investigator as to what additional investigation needs to be carried out.

In normal investigation practice, gaps in information that cannot be resolved are usually filled in by logical extrapolation and reasonable assumptions. Such extrapolation and assumptions should be identified and a statement of the measure of certainty provided.

Despite best efforts, analysis may not lead to firm conclusions. In these cases, the more likely hypotheses should be presented.

2.4.1 Fact-finding and analysis

After fact-finding and analysis it should be possible to give a description of the occurrence, its background, the time it took place, and the events leading to it.

The description should include such factual items as:

- the weather conditions;
- the operation(s) involved;
- the equipment in use, its capabilities, performance and any failures;
- the location of key personnel and their actions immediately before the incident;
- the pertinent regulations and instructions;
- uncontrolled hazards;
- changes of staff, procedures, equipment or processes that could have contributed to the occurrence;
- what safeguards were or were not in place to prevent the incident;
- response to the occurrence (first-aid, shut-down, fire-fighting, evacuation, search and rescue);
- medical treatment actions taken to mitigate the effects of the occurrence and the condition of injured parties, particularly if disabling injuries or death ensued;

- damage control including salvage;
- inventory of all consequences of the occurrence (injury, loss, damage or environmental damage); and
- general ship's condition.

It should also be possible to identify active and underlying factors such as:

- operational deviations;
- design aspects of hull structural failure;
- defects in resources and equipment;
- inappropriate use of resources and equipment;
- relevant personnel skill levels and their application;
- physiological factors (e.g. fatigue, stress, alcohol, illegal drugs, prescription medicine);
- why safeguards in place were inadequate or failed;
- role of safety programmes;
- problems relating to the effectiveness of regulations and instructions;
- management issues; and
- communication issues.

2.5 Safety action

2.5.1 The ultimate goal of a marine safety investigation is to advance maritime safety and protection of the marine environment. In the context of these Guidelines, this goal is achieved by identifying safety deficiencies through a systematic investigation of marine casualties and incidents, and then recommending or effecting change in the maritime system to correct these deficiencies.

2.5.2 In a report that clearly lays out the facts relevant to the occurrence, and then logically analyses those facts to draw reasoned conclusions including those relating to human factors, the required safety action may appear self-evident to the reader.

2.5.3 Recommended safety action in whatever form should clearly identify what needs to be done, who or what organization is responsible for effecting change, and, where possible, the urgency for completion of the change.

3 REPORTING PROCEDURES

3.1 To facilitate the flow of information from casualty investigations, each report should conform to a basic format as outlined in section 14 of this resolution.

3.2 Reports should be made to IMO in accordance with established procedures[3].

3.3 Persons and/or organizations with a vested interest in a report should be given the opportunity to comment on the report or relevant parts thereof before it is finalized.

3.4 The final report should be distributed to relevant parties involved and should preferably be made public.

4 QUALIFICATIONS AND TRAINING OF INVESTIGATORS

4.1 A variety of contributory factors can play a significant part in the events preceding a marine casualty or incident. The question of who should be charged with the responsibility for investigatin and analysing human factors therefore becomes important. The skilled marine casualty and incident investigator generally is the person best suited to conduct all but the most specialized aspects of human factor investigation.

4.2 An investigator should have appropriate experience and formal training in marine casualty investigation. The formal training should include specific training in the identification of human factors in marine casualties and incidents.

4.3 In some cases, a human factors specialist may be of significant value in the investigation.

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[3] Refer to MSC/Circ.827-MEPC/Circ.333 of 9 December 1997 on reports on marine casualties and incidents.

RESOLUTION A.849(20)
adopted on 27 November 1997

CODE FOR THE INVESTIGATION OF MARINE CASUALTIES AND INCIDENTS

THE ASSEMBLY,

RECALLING article 15(j) of the Convention on the International Maritime Organization concerning the functions of the Assembly in relation to regulations and guidelines concerning maritime safety and the prevention and control of marine pollution from ships,

NOTING with concern that, despite the best endeavours of the Organization, casualties and incidents resulting in loss of life, loss of ships and pollution of the marine environment continue to occur,

NOTING ALSO that the safety of seafarers and passengers and the protection of the marine environment can be enhanced by timely and accurate reports identifying the circumstances and causes of marine casualties and incidents,

NOTING FURTHER the rights and obligations of coastal and flag States under the provisions of articles 2 and 94 of the United Nations Convention on the Law of the Sea (UNCLOS),

NOTING IN ADDITION the responsibilities of flag States under the provisions of the International Convention for the Safety of Life at Sea, 1974 (regulation I/21), the International Convention on Load Lines, 1966 (article 23) and the International Convention for the Prevention of Pollution from Ships, 1973 (article 12), to conduct casualty investigations and to supply the Organization with relevant findings,

CONSIDERING the need to ensure that flag States are required, under the aforementioned conventions, to investigate all cases of serious and very serious casualties,

ACKNOWLEDGING that the investigation and proper analysis of marine casualties and incidents can lead to greater awareness of casualty causation and result in remedial measures, including better training, for the purpose of enhancing safety of life at sea and protection of the marine environment,

RECOGNIZING the need for a code to provide, as far as national laws allow, a standard approach to marine casualty and incident investigation with the sole purpose of correctly identifying the causes and underlying causes of casualties and incidents,

RECOGNIZING ALSO the international nature of shipping and the need for co-operation between Governments having a substantial interest in a marine casualty or incident for the purpose of determining the circumstances and causes thereof, HAVING CONSIDERED the recommendations made by the Maritime Safety Committee at its sixty-eighth session and by the Marine Environment Protection Committee at its fortieth session:

1. ADOPTS the Code for the Investigation of Marine Casualties and Incidents set out in the Annex to the present resolution;

2. INVITES all Governments concerned to take appropriate measures to give effect to the Code as soon as possible;

3. REQUESTS flag States to conduct an investigation into all very serious and serious marine casualties and to supply the Organization with all relevant findings;

4. REVOKES resolutions A.173(ES.IV), A.440 (XI) and A.637(16).

ANNEX

CODE FOR THE INVESTIGATION OF MARINE CASUALTIES AND INCIDENTS

1 Introduction

1.1 This Code recognizes that under IMO conventions each flag State has a duty to conduct an investigation into any casualty occurring to any of its ships when it judges that such an investigation may assist in determining what changes in the present regulations may be desirable or if such a casualty has produced a major deleterious effect upon the environment. The Code also takes into account that under the provisions of UNCLOS article 94, a flag State shall cause an inquiry to be held, by or before a suitably qualified person or persons into certain casualties or incidents of navigation on the high seas. However, the Code also recognises that where a casualty occurs within the territorial sea or internal waters of a State, that State has a right, under UNCLOS article 2, to investigate the cause of any such casualty which might pose a risk to life or to the environment, involve the coastal State's search and rescue authorities, or otherwise affect the coastal State.

1.2 The aim of this Code is to promote a common approach to the safety investigation of marine casualties and incidents, and also to promote co-operation between States in identifying the contributing factors leading to marine casualties. The result of this common approach and co-operation will be to aid remedial action and to enhance the safety of seafarers and passengers and the protection of the marine environment. In achieving these aims, this Code recognizes the need for mutual respect for national rules and practices and puts particular emphasis upon co-operation.

1.3 By introducing a common approach to marine casualty investigations and the reporting on such casualties, the international maritime community may be better informed about the factors which lead up to and cause, or contribute to, marine casualties. This may be facilitated by:

.1 Clearly defining the purpose of marine casualty investigation and the guiding principles for its conduct.

.2 Defining a framework for consultation and co-operation between substantially interested States.

.3 Recognizing that the free flow of information will be promoted if individuals who are attempting to assist the investigation may be offered a degree of immunity, both from self-incrimination and from any ensuing risk to their livelihood.

.4 Establishing a common format for reports to facilitate publication and sharing of the lessons to be learned.

1.4 It is not the purpose of the Code to preclude any other form of investigation, whether for civil, criminal, administrative, or any other form of action, but to create a marine casualty investigation process the aim of which is to establish the circumstances relevant to the casualty, to establish the causal factors, to publicise the causes of the casualty and to make appropriate safety recommendations. Ideally, marine casualty investigation should be separate from, and independent of, any other form of investigation.

2 Objective

The objective of any marine casualty investigation is to prevent similar casualties in the future. Investigations identify the circumstances of the casualty under investigation and establish the causes and contributing factors, by gathering and analysing information and drawing conclusions. Ideally, it is not the purpose of such investigations to determine liability, or apportion blame. However, the investigating authority should not refrain from fully reporting the causes because fault or liability may be inferred from the findings.

3 Application

This Code applies, as far as national laws allow, to the investigation of marine casualties or incidents where either one or more interested States have a substantial interest in a marine casualty involving a ship under their jurisdiction.

4 Definitions

For the purpose of this Code:

4.1 *Marine casualty* means an event that has resulted in any of the following:

.1 the death of, or serious injury to, a person that is caused by, or in connection with, the operations of a ship; or

.2 the loss of a person from a ship that is caused by, or in connection with, the operations of a ship; or

.3 the loss, presumed loss or abandonment of a ship; or

.4 material damage to a ship; or

.5 the stranding or disabling of a ship, or the involvement of a ship in a collision; or

.6 material damage being caused by, or in connection with, the operation of a ship; or

.7 damage to the environment brought about by the damage of a ship or ships being caused by, or in connection with, the operations of a ship or ships.

4.2 *Very serious casualty* means a casualty to a ship which involves the total loss of the ship, loss of life or severe pollution.

4.3 *Serious casualty* means a casualty which does not qualify as a very serious casualty and which involves:

.1 a fire, explosion, grounding, contact, heavy weather damage, ice damage, hull cracking or suspected hull defect, etc., resulting in;

.2 structural damage rendering the ship unseaworthy, such as penetration of the hull underwater, immobilization of main engines, extensive accommodation damage etc.; or

.3 pollution (regardless of quantity); and/or

.4 a breakdown necessitating towage or shore assistance.

4.4 *Marine incident* means an occurrence or event being caused by, or in connection with, the operations of a ship by which the ship or any person is imperilled, or as a result of which serious damage to the ship or structure or the environment might be caused.

4.5 *Causes* means actions, omissions, events, existing or pre-existing conditions or a combination thereof, which led to the casualty or incident.

4.6 *Marine casualty or incident safety investigation* means a process held either in public or in camera conducted for the purpose of casualty prevention which includes the gathering and analysis of information, the drawing of conclusions, including the identification of the circumstances and the determination of causes and contributing factors and, when appropriate, the making of safety recommendations.

4.7 *Marine casualty investigator* means a person or persons qualified and appointed to investigate a casualty, or incident, under procedures laid down in national legislation for the furtherance of marine safety and protection of the marine environment.

4.8 *Serious injury* means an injury which is sustained by a person in a casualty resulting in incapacitation for more than 72 hours commencing within seven days from the date of injury.

4.9 *Ship* means any kind of vessel which is used in navigation by water.

4.10 *Lead investigating State* means the State that takes responsibility for the conduct of the investigation as mutually agreed between the substantially interested States.

4.11 *Substantially interested State* means a State:

.1 which is the flag State of a ship that is the subject of an investigation; or

.2 in whose internal waters or territorial sea a marine casualty has occurred; or

.3 where a marine casualty caused, or threatened, serious harm to the environment of that State, or within those areas over which the State is entitled to exercise jurisdiction as recognised under international law; or

.4 where the consequences of a marine casualty caused, or threatened, serious harm to that State or to artificial islands, installations, or structures over which it is entitled to exercise jurisdiction; or

.5 where, as a result of a casualty, nationals of that State lost their lives or received serious injuries; or

.6 that has at its disposal important information that may be of use to the investigation; or

.7 that for some other reason establishes an interest that is considered significant by the lead investigating State.

5 Conduct of marine casualty investigations

5.1 Where an investigation is to be conducted, the following should be taken into consideration:

.1 Thorough and unbiased marine casualty investigations are the most effective way of establishing the circumstances and causes of a casualty.

.2 Only through co-operation between States with a substantial interest can a full analysis be made of a marine casualty.

.3 Marine casualty investigations should be given the same priority as criminal or other investigations held to determine responsibility or blame.

.4 Marine casualty investigators should have ready access to relevant safety information including survey records held by the flag State, the owners, and classification societies. Access to information should not be barred by reason of competing investigations.

.5 Effective use should be made of all recorded data, including voyage data recorders (VDR), if fitted, in the investigation of a marine casualty or marine incident wherever it occurred. The State conducting the investigation should arrange for the read-out of the VDR.

.6 Marine casualty investigators should be afforded access to Government surveyors, coastguard officers, vessel traffic service operators, pilots or other marine personnel of the respective States.

.7 The investigation should take into account any recommendations or instruments published by IMO or ILO, in particular those relating to the human factor, and any other recommendations or instruments adopted by other relevant international organizations.

.8 Reports of investigations are most effective when released to the shipping industry and public.

5.2 In accordance with 9, other substantially interested States should be invited to be represented during any such investigation and should be admitted as a party in the proceedings and have equal standing, rights and access to evidence as the State conducting the investigation.

5.3 Recognizing that any vessel involved in a casualty may continue in service and that a ship should not be delayed more than is absolutely necessary, the State conducting the investigation should start the investigation as soon as practicable, without delaying the ship unreasonably. Other substantially interested States may, by mutual agreement, join the investigation either immediately or at a later stage.

6 Responsibility for investigating casualties and incidents

6.1 Flag States are encouraged to ensure that investigations are carried out into all casualties occurring to its ships. All cases of serious and very serious casualties should be investigated.

6.2 Where a marine casualty or incident occurs within the territorial sea of a State, the flag and coastal States recognizing the obligations of that State to its citizens and the legal status of the territorial sea under the provisions of UNCLOS and also recognising the duties placed on a flag State, the flag and coastal States should co-operate to the maximum extent possible, and mutually agree which State should take the role of lead investigating State.

6.3 Where a marine casualty or incident occurs on the high seas, a flag State should carry out an investigation into a casualty to, or on, any of its ships. If that casualty is a collision involving a ship of another flag State, then the States should consult with each other and agree which will be the lead investigating State and determine the best means of co-operation under this Code. In line with 9.1, if another State is a substantially interested State by virtue of the nationality of the ship's crew, passengers or other persons, or the location of the casualty, that State or States should be invited to take part in the investigation.

6.4 By fully participating in an investigation conducted by another substantially interested State, the flag State shall be considered as fulfilling its obligations under UNCLOS article 94, section 7.

6.5 An investigation should be started as soon as practicable after the casualty occurs. Substantially interested States should, by mutual agreement, be allowed to join an investigation conducted by another substantially interested State at any stage of the investigation.

7 Responsibilities of the lead investigating State

The lead investigating State should be responsible for:

.1 developing a common strategy for investigating the casualty in liaison with substantially interested States;

.2 providing the investigator in charge and co-ordinating the investigation;

.3 establishing the investigation parameters based on the laws of the investigating State and ensuring that the investigation respects those laws;

.4 being the custodian of records of interviews and other evidence gathered by the investigation;

.5 preparing the report of the investigation, and obtaining and reflecting the views of the substantially interested States;

.6 co-ordinating, when applicable, with other agencies conducting other investigations;

.7 providing reasonable logistical support; and for

.8 liaison with agencies, organizations and individuals not part of the investigating team.

8 Consultation

8.1 Notwithstanding the obligation placed on the master or owners of a ship to inform its flag State authority of any casualty occurring to the ship, where a casualty or incident occurs in the internal waters or territorial sea of another State, the coastal State should notify, with a minimum of delay, the flag State or States of the circumstances and what, if any, action is proposed by the coastal State.

8.2 Following a casualty, the investigating State should inform the other substantially interested States, either through the Consular Office in that State or by contacting the relevant authorities listed in MSC/Circ.781/ MEPC.6/Circ.2. That State and the other substantially interested States should consult, at the earliest opportunity, on the conduct of the investigation and to determine details of co-operation.

8.3 Nothing should prejudice the right of any State to conduct its own separate investigation into a marine casualty occurring within its jurisdiction according to its own legislation. Ideally, if more than one State desires to conduct an investigation of its own, the procedures recommended by this Code should be followed, and those States should co-ordinate the timing of such investigations to avoid conflicting demands upon witnesses and access to evidence.

9 Co-operation

9.1 Where two or more States have agreed to co-operate and have agreed the procedures for a marine casualty investigation, the State conducting the investigation should invite representatives of other substantially interested States to take part in the investigation and, consistent with the purpose of this Code, allow such representatives to:

.1 question witnesses;

.2 view and examine evidence and take copies of documentation;

.3 produce witnesses or other evidence;

.4 make submissions in respect of the evidence, comment on and have their views properly reflected in the final report; and

.5 be provided with transcripts, statements and the final report relating to the investigation.

9.2 States are encouraged to provide for maximum participation in the investigation by all States with a substantial interest in the marine casualty.

9.3 The flag State of a ship involved in a marine casualty should help to facilitate the availability of the crew to the investigation and encourage the crew to co-operate with the State conducting the investigation.

10 Disclosure of records

10.1 The State conducting the investigation of a casualty or incident, wherever it has occurred, should not make the following records, obtained during the conduct of the investigation, available for purposes other than casualty investigation, unless the appropriate authority for the administration of justice in that State determines that their disclosure outweighs any possible adverse domestic and international impact on that or any future investigation, and the State providing the information authorizes its release:

.1 all statements taken from persons by the investigating authorities in the course of the investigation;

.2 all communications between persons having been involved in the operation of the ship;

.3 medical or private information regarding persons involved in the casualty or incident;

.4 opinions expressed during the conduct of the investigation.

10.2 These records should be included in the final report, or its appendices, *only* when pertinent to the analysis of the casualty or incident. Parts of the record not pertinent, and not included in the final report, should not be disclosed.

11 Personnel and material resources

Governments should take all necessary steps to ensure that they have available sufficient means and suitably qualified personnel and material resources to enable them to undertake casualty investigations.

12 Issue of marine casualty reports and submission to IMO

12.1 The lead investigating State should send a copy of the draft of the final report to all substantially interested States, inviting their significant and substantiated comments on the report as soon as possible. If the lead investigating State receives comments within thirty days, or within some mutually agreed period, it should either amend the draft final report to include the substance of the comments, or append the comments to the final report. If the lead investigating State receives no comments after the mutually agreed period has expired, it should send the final report to the Organization in accordance with applicable requirements and cause the report to be published.

12.2 By fully participating in an investigation conducted by another substantially interested State that will be reporting to IMO, the flag State shall be considered as fulfilling its obligations under IMO conventions.

12.3 Reports, or relevant parts of reports, into the circumstances and causes of a marine casualty should be completed as quickly as practicable, and be made available to the public and the shipping industry in order to enhance safety of life at sea and protection of the marine environment through improved awareness of the factors which combine to cause marine casualties.

12.4 Where a substantially interested State disagrees with whole or part of the report referred to in 12.1 above, it may submit its own report to the Organization.

12.5 The investigating State, upon determining that urgent safety action is needed, may initiate interim recommendations to the appropriate authority.

13 Re-opening of investigations

When new evidence relating to any casualty is presented, it should be fully assessed and referred to other substantially interested States for appropriate input. In the case of new evidence which may materially alter the determination of the circumstances under which the marine casualty occurred, and may materially alter the findings in relation to its cause or any consequential recommendations, States should reconsider their findings.

14 Contents of reports

14.1 To facilitate the flow of information from casualty investigations, each report should conform to the basic format outlined in 14.2 below.

14.2 Reports should include, wherever possible:

.1 a summary outlining the basic facts of the casualty and stating whether any deaths, injuries or pollution occurred as a result;

.2 the identity of the flag State, owners, managers, company and classification society;

.3 details of the dimensions and engines of any ship involved, together with a description of the crew, work routine and other relevant matters, such as time served on the ship;

.4 a narrative detailing the circumstances of the casualty;

.5 analysis and comment which should enable the report to reach logical conclusions, or findings, establishing all the factors that contributed to the casualty;

.6 a section, or sections, analysing and commenting on the causal elements, including both mechanical and human factors, meeting the requirements of the IMO casualty data base; and

.7 where appropriate, recommendations with a view to preventing similar casualties.

15 Contact between Administrations

To facilitate implementation of this Code, States should inform the Organization of the responsible authorities within their Governments that may be contacted regarding cooperation in casualty investigations.

Appendix

Guidelines to assist investigators in the implementation of the Code

Introduction

The contents of this section should be treated as guidelines to assist investigators co-operating in an investigation. Investigators should bear in mind the information required under the IMO marine casualties and incidents reporting system.

In following this Code, participating investigators must be guided by the requirements of the legal system of the State in which the investigation is being conducted. In particular, co-operating investigators must be guided by the requirements of national law over issues such as:

- providing formal notification of an investigation to interested parties;
- boarding ships and securing documents;
- arranging interviews with witnesses;
- the presence of legal advisers or other third parties during an interview.

1. Information generally required in all cases

1.1 Particulars of the ship

Name, IMO number, nationality, port of registry, call sign
Name and address of owners and operators, if applicable, also, if an overseas ship, of agents
Type of ship
Name and address of charterer, and type of charter
Deadweight, net and gross tonnages, and principal dimensions
Means of propulsion; particulars of engines
When, where and by whom built
Any relevant structural peculiarities
Amount of fuel carried, and position of fuel tanks
Radio (type, make)
Radar (number, type, make)
Gyro compass (make, model)
Automatic pilot (make, model)
Electronic positioning equipment (make, model) (GPS, Decca, etc.)
Life saving equipment (dates of survey/expiry)

JICA