

Document of  
The World Bank

FOR OFFICIAL USE ONLY

Report No: 34042-ID

PROJECT APPRAISAL DOCUMENT

ON

TWO PROPOSED GRANTS FROM THE  
GLOBAL ENVIRONMENT FACILITY TRUST FUND

TO THE

INTERNATIONAL MARITIME ORGANIZATION  
IN THE AMOUNT OF US\$6.86 MILLION

AND TO THE

REPUBLIC OF INDONESIA  
IN THE AMOUNT OF US\$1.44 MILLION

FOR A

MARINE ELECTRONIC HIGHWAY DEMONSTRATION PROJECT

May 2, 2006

**Transport Sector Unit**  
**East Asia and Pacific Region**

This document has a restricted distribution and may be used by recipients only in the performance of their official duties. Its contents may not otherwise be disclosed without World Bank authorization.

## CURRENCY EQUIVALENTS

(Exchange Rate Effective December 2005)

Currency Unit	=	US\$
Indonesia Rupiah 10,000	=	US\$1
Malaysia Ringgit 3.78	=	US\$1
Singapore Dollar 1.647	=	US\$1

FISCAL YEAR (International Maritime Organization and Republic of Indonesia)

January 1 – December 31

## ABBREVIATIONS AND ACRONYMS

AIS	Automatic Identification System
DGPS	Differential Global Positioning System
DGST	Directorate General of Sea Transport, Ministry of Transport
ECDIS	Electronic Chart Display and Information System
EMPS	Environmental Management and Protection System
ENC	Electronic Navigation Charts
GEF	Global Environmental Facility
FMR	Financial Monitoring Report
ICB	International Competitive Bidding
ICS	International Chamber of Shipping
IHO	International Hydrographic Organization
IMO	International Maritime Organization
INTERTANKO	International Association of Independent Tankers Owners
MEH	Marine Electronic Highway
MOE	Ministry of Environment (Republic of Indonesia)
MOT	Ministry of Transport (Republic of Indonesia)
MOU	Memorandum of Understanding
PIP	Project Implementation Plan
PMO	Project Management Office
PSC	Project Steering Committee
STRAITREP	Straits of Malacca and Singapore Mandatory Ship Reporting System
TC	Technical Committee
TSS	Traffic Separation Scheme
ULCC	Ultra Large Crude Carrier
VLCC	Very Large Crude Carrier
WG	Working Group

Acting Vice President:	Jeffrey Gutman
Country Manager/Director:	Andrew Steer, Ian Porter
Sector Manager:	Jitendra N. Bajpai
Task Team Leader:	Sally Burningham

# MARINE ELECTRONIC HIGHWAY DEMONSTRATION PROJECT

## CONTENTS

<b>A. STRATEGIC CONTEXT AND RATIONALE .....</b>	<b>1</b>
1. Country and sector issues.....	1
2. Rationale for Bank and Global Environmental Facility (GEF) involvement .....	2
3. Higher level objectives to which the project contributes.....	3
<b>B. PROJECT DESCRIPTION .....</b>	<b>3</b>
1. Lending instrument .....	3
2. Program objective and phases.....	4
3. Project development and global environment objectives and key indicators .....	4
4. Project components.....	5
5. Lessons learned and reflected in the project design.....	8
6. Alternatives considered and reasons for rejection .....	8
<b>C. IMPLEMENTATION .....</b>	<b>9</b>
1. Partnership arrangements.....	9
2. Institutional and implementation arrangements.....	9
3. Monitoring and evaluation of outcomes/results.....	10
4. Sustainability and Replicability .....	10
5. Critical risks and possible controversial aspects.....	10
6. Grant conditions and covenants .....	12
<b>D. APPRAISAL SUMMARY .....</b>	<b>15</b>
1. Economic and financial analyses .....	15
2. Technical.....	15
3. Fiduciary .....	16
4. Social.....	17
5. Environment.....	17
6. Safeguard policies.....	18
7. Policy Exceptions and Readiness.....	18

<b>Annex 1: Country and Sector or Program Background .....</b>	<b>19</b>
<b>Annex 2: Major Related Projects Financed by the Bank and/or other Agencies .....</b>	<b>21</b>
<b>Annex 3: Results Framework and Monitoring .....</b>	<b>22</b>
<b>Annex 4: Detailed Project Description.....</b>	<b>26</b>
<b>Annex 5: Project Costs .....</b>	<b>35</b>
<b>Annex 6: Implementation Arrangements .....</b>	<b>38</b>
<b>Annex 7: Financial Management and Disbursement Arrangements.....</b>	<b>44</b>
<b>Annex 8: Procurement Arrangements .....</b>	<b>49</b>
<b>Annex 9: Economic and Financial Analysis .....</b>	<b>55</b>
<b>Annex 10: Safeguard Policy Issues.....</b>	<b>64</b>
<b>Annex 11: Project Preparation and Supervision .....</b>	<b>65</b>
<b>Annex 12: Documents in the Project File .....</b>	<b>66</b>
<b>Annex 13: Statement of Loans and Credits.....</b>	<b>68</b>
<b>Annex 14: Country at a Glance .....</b>	<b>71</b>
<b>Annex 15: Incremental Cost Analysis .....</b>	<b>73</b>
<b>IBRD Maps 34371 and 34372</b>	

## **A. STRATEGIC CONTEXT AND RATIONALE**

### **1. Country and sector issues**

The Straits of Malacca and Singapore, situated between Sumatra and the Malay Peninsula, are approximately 1,000 kilometers long, 300 kilometers wide at their north-west entrance, and just 12 kilometers wide at their south-east entrance, between Singapore and Indonesia's Riau Archipelago. They are shallow, with narrow channels, irregular tides and shifting bottom topography, and hence are hazardous to navigation for large ships. They are also rich in natural resources on which many of the coastal inhabitants depend.

Despite their difficult navigational features, the Straits are the shortest and hence the preferred shipping route between the Indian Ocean and the South China Sea, and for oil tankers trading between the Persian Gulf and the fast-growing countries of East Asia. Over 200 very large crude carriers and container ships pass through the Straits each day, and traffic is growing by 10 percent per year. There is also much cross-Straits traffic which cuts through the major shipping lanes.

Recent enhancements in maritime safety infrastructure and regulatory mechanisms have improved navigational safety and traffic flow. Singapore has an efficient radar-based ship position monitoring system covering the Singapore Strait. In 1998, the three littoral states of Republic of Indonesia, Malaysia, and Republic of Singapore jointly commissioned a mandatory ship reporting system (STRAITREP) for the most congested 300 kilometer section of the Straits from One Fathom Bank to the Singapore Strait, which combines radar and automatic ship identification and tracking.

These recent improvements to navigational aids and facilities have reduced the frequency of ship collisions, groundings and oil spills. However, several vessel collisions and groundings occurred in the past five years that caused significant oil spills, such as those involving the 'Natuna Sea' (October 2000) and the 'Singapora Timur' (May 2001). Total compensation claims for the 'Natuna Sea' accident were over US\$127 million. A recent economic valuation of the natural resources at risk in the Malacca Straits estimated them at US\$5 billion and identified more than 50 species of marine coral and fish on the endangered species list. So, despite the improved navigation system, the threat of collisions and groundings and of consequent environmental damage is still significant and, with rapid traffic growth, is increasing.

The three littoral states have oil spill response capabilities and oil spill contingency plans, including a cooperative response agreement. However, the several recent serious shipping accidents highlighted the need for an improved ship management system, for quicker and more accurate deployment of spill response equipment and manpower, and for more efficient institutional arrangements for dealing with oil spills. In addition to more rapid response, immediate access to information on spill location and track and the environmental resources at risk are also needed if the impact of any spill is to be minimized. Better communication is the key to more effective oil spill response, but a more effective ship monitoring and control system is required to prevent major incidents, as well as to serve as early warning of their potential environmental damage and where such damage will occur.

Recent advances in marine navigation, communications and environmental impact prediction technologies offer an opportunity to upgrade existing systems to further reduce the risk of ship accidents in the Straits and the environmental damage they cause. By providing mariners with very accurate, real-time navigational information (depth, tide, and location of sand bars) the new technologies could also reduce shipping costs by permitting safe navigation in poor weather and optimal loading and may even reduce marine insurance costs.

The best-proven of the new marine navigation technologies is the “Marine Electronic Highway” (MEH). First installed in Canada’s St. Lawrence River in the early 1990s, a MEH combines an Electronic Chart Display and Information System (ECDIS), an Automated Identification System (AIS), shore-based marine information databases and advanced ship-to-shore communications. The ECDIS involves the use of Electronic Navigation Charts which replaces traditional paper charts as the ship operator’s primary navigation tool. It shows the ship’s exact location, plus real-time data on water depth, tidal flow and navigational risks. The AIS gives shore controllers precise information on ship location, direction and speed, which help them avert collisions or groundings. The same data used to compile the electronic navigation charts can predict the direction and speed of any oil spill movements and help to identify and deter ships that illegally flush their bilges or dump other oily wastes. The foundation for this technology already exists in the Straits and the littoral states are committed to its installation, however the cost to them of developing and operating it, and the uncertainty of whether they can recover those costs, has deterred them from making the investment. An external catalyst is needed to bring about the new institutional arrangements between national governments, the International Maritime Organization and the ship operators that are needed to make the system work.

## **2. Rationale for Bank and Global Environmental Facility (GEF) involvement**

The rationale for Bank involvement is that the Bank has a unique combination of convening power and technical skills that can help the littoral states overcome the barriers that have prevented implementation of the system until now. The Bank can facilitate collaboration between the International Maritime Organization, the international institution responsible for promoting environmentally-sound marine navigation, the International Hydrographic Organization, responsible for marine mapping, major international ship-owner representative organizations and the governments of the three littoral states. Financially, it can access the resources of GEF, which, in its International Waters Focal Area, can provide grant or concessional funding to help countries address major environmental threats to shared water bodies, such as the Straits of Malacca and Singapore.

The Marine Electronic Highway Demonstration Project is consistent with one of the major objectives of the GEF's International Waters Operational Program 10, as it will overcome the barriers to the adoption of best-practice technology in marine navigation and pollution control in the Straits, and thereby reduce the risk of contamination of an international water body. As the project is a partnership between governments, the GEF and the private sector, it is also consistent with one of the GEF's key strategic objectives, to promote public-private partnerships that benefit the global environment.

GEF support for the Project is further justified because the Straits of Malacca and Singapore is a zone of high marine biological diversity, rich in the marine fauna and flora that are characteristic of tropical estuarine environments. The abundance of sea-grass beds, mangrove swamps, coral reefs, and wetlands, enriches the associated coastal marine environments, which are also stopovers for migratory birds on seasonal transition. Natural resource-related activities, such as fishing and coastal tourism, are key to the regional economy. By catalyzing the development of a Marine Electronic Highway that will protect these natural resources, the GEF can help achieve global and local environmental benefits and poverty reduction, which is also the Bank's core objective.

### **3. Higher level objectives to which the project contributes**

The Marine Electronic Highway (MEH) Demonstration Project is the first (demonstration) phase of a proposed two-phase program to establish a MEH in the Straits of Malacca and Singapore. The Demonstration Project's objective is to determine if a full-scale MEH for the Straits is economically justified and financially feasible. If the MEH is successful in the Straits of Malacca and Singapore, it has the potential to be extended to the whole shipping route from Europe and the Middle East to East Asia. Other East Asian countries have already expressed interest in such an extension and are awaiting the outcome of the demonstration phase before taking specific actions on extension. There is also interest from states that are littoral to other major sea lanes in applying the MEH principles and methods to their own regions.

## **B. PROJECT DESCRIPTION**

### **1. Lending instrument**

The Bank mobilized co-financing for this project in the form of a Global Environment Facility grant. This is the most appropriate co-financing instrument since: (a) the feasibility of the Marine Electronic Highway (MEH) system that the Project will demonstrate and test is unproven, and (b) the MEH system promises to deliver significant global as well as local environmental benefits. The bulk of the non-Bank co-financing will be provided by the commercial shipping industry, which is appropriate since it stands to gain commercial benefit from a successful MEH system.

Commitment of the littoral states and other essential participants in the Project has been confirmed by the signing of two Memoranda on September 8, 2005:

- a *Memorandum of Understanding* among the three littoral states, Indonesia, Malaysia, Singapore, and the International Maritime Organization. Articles IIIA and IIIB of this Memorandum show the roles and responsibilities of the International Maritime Organization and the Republic of Indonesia (through the Ministry of Environment) respectively, and;
- a *Memorandum on Arrangements* among the three littoral states, Indonesia, Malaysia, Singapore, and the International Maritime Organization, the International Hydrographic Organization, the International Association of Independent Tanker Owners, and the International Chamber of Shipping. This Memorandum indicates the arrangements for the implementation of specific activities.

## **2. Program objective and phases**

The program's objective is to reduce the user costs and environmental damage of marine navigation through the Straits of Malacca and Singapore (the Straits). These objectives will be achieved by developing a Marine Electronic Highway (MEH) for the entire Straits (approximately 1,000 kilometers) which will: (a) reduce the frequency of ship collisions in the Straits' busy and congested sea lanes and port arrival and departure areas; (b) make marine navigation in the Straits feasible more often in poor weather; (c) allow ships in transit to optimize their loads for passage through the Straits; (d) facilitate more effective monitoring of vessel operations, such as illegal bilge water releases, thus deterring such environmentally-damaging behavior; and (e) generate more resources and increase capacity for environmental protection of the Straits and its surrounding coasts.

This first phase Project will facilitate the program's objective by: (a) developing and testing a demonstration MEH system for the most congested 300 kilometer section of the Straits; and (b) based on the results of these tests and on international marine navigation law, assessing the financial, economic, and legal feasibility and environmental benefits of developing a MEH system for the entire Straits. If, based on the results of this assessment, the three participating littoral states and representatives of the international shipping industry decide to develop such a system, the project will prepare the design of, and financing and institutional plan for, a MEH system covering the entire Straits.

The expected duration of the MEH Demonstration Project is four years and its total cost is about US\$17 million. The Project's implementation will be coordinated and technically supported by the International Maritime Organization, on behalf of the littoral states. The Governments of Indonesia, Malaysia and Singapore, primarily through their ministries responsible for marine navigation and the environment, will collaborate on and steer the project. The trigger for moving from phase one to phase two of the program to develop a Marine Electronic Highway for the entire Straits of Malacca and Singapore will be a decision by the concerned governments and representatives of the commercial shipping industry. The cost of such a system is not known at this time, but will be estimated by the Project. The process of designing the Full-Scale MEH system will take account of the rapid advances in marine navigation technology that are currently occurring.

## **3. Project development and global environment objectives and key indicators**

The Project's development objective is to assist the Republic of Indonesia, Malaysia, the Republic of Singapore and representatives of some of the large commercial ship owners that use the Strait of Malacca and the Strait of Singapore, to collectively decide whether to establish a marine electronic highway for the entire length of the Straits of Malacca and Singapore. The indicator of the Project's success is that these key stakeholders reach a decision on this issue.

The Project's global environment objective is to improve maritime safety and reduce environmental damage to the globally-significant shared natural resources of the Straits of Malacca and Singapore. It will not be possible to determine with certainty if it has achieved this objective in its short life. An evaluation of the Marine Electronic Highway demonstration

system's technical performance and the project stakeholders' decision whether to maintain and/or expand it will indicate if this objective is likely to be achieved in the longer term.

#### **4. Project components**

The Project has five components (see Annex 4 for a detailed description). The total Project cost is US\$17 million, of which US\$8.3 million will be financed by the Global Environment Facility, US\$6.0 million by private sector participants (ship-owners), and US\$2.7 million by the three littoral states. The International Maritime Organization (IMO) will manage all components of the project. The Republic of Indonesia will execute the Tide and Current Facilities of Component 2.

##### **Component 1: MEH System Design, Coordination and Operation (US\$2.88 million)**

This component will provide for project management by the IMO on behalf of the participating states, coordination of the design, development and operation of the MEH demonstration system and also provide for key technical inputs to the project. The main functions will be performed by the staff of a Project Management Office (PMO), which will operate under the responsibility of the IMO. The PMO will be located on the island of Batam, Indonesia, almost directly across the Straits from Singapore. It will be co-located with Indonesian Government's marine management bureau that is responsible for the Indonesian waters of the MEH demonstration section and will be housed in facilities provided and serviced by the Government of Indonesia.

The major tasks to be undertaken within this component will be:

1. System Planning and International Maritime Organization Management
  - (a) Management of the operational aspects of the Project by the International Maritime Organization.
  - (b) Development of a system for the management and on-line access and storage of data and information, including links to the MEH Data Centers and financial and economic assessments.
  - (c) Development of criteria and measurable indicators for Project performance assessment, including the carrying out of a baseline survey to compile and analyze data and information covering a period of about thirty years up to the inception of the Project, as a basis for evaluation of the impact of the MEH system.
2. Project Management Office
  - (a) Strengthening the capacity of the staff of the Project Management Office, including relevant training.
  - (b) Establishment of MEH Data Centers in the Republic of Indonesia, Malaysia and the Republic of Singapore, including provision of relevant training to the staff of the MEH Data Centers in operation and management of the MEH system and in data handling and exchange.
3. Project Steering Committee Support. Carrying out of meetings of the Project Steering Committee (PSC), the Technical Committees (TCs) and the Working Groups (WGs), including travel and accommodations for participants.

Incremental Operating Costs are included in the above component and covers costs which would not have been incurred without the project and includes travel and per diem by staff of the PMO, PSC, WGs and TCs, communications, consumables, advertising of bidding, printing and publication of Project information, rental of meeting facilities, but excludes staff salaries.

### **Component 2: MEH System Development (US\$7.04 million)**

This component will provide for production of the navigational information on which the MEH system will be based, and its incorporation into real-time Electronic Navigation Charts that ship operators will be able to use to navigate with precision through the MEH demonstration section of the Straits. These activities will be coordinated by the PMO, under the direction of the IMO, and comprise the following sub components:

1. Tide and Current Facilities. Tidal and current monitoring on the Republic of Indonesia's coast of the Strait of Malacca, including provision of relevant equipment.
2. Hydrographic Survey. (a) Carrying out of a hydrographic survey within the designated traffic separation scheme in the Strait of Malacca within the Project Area and (b) Provision of training to the hydrographic surveyors of the hydro-oceanographic services of the Republic of Indonesia, Malaysia and the Republic of Singapore.
3. Electronic Navigation Charts. Production of high resolution electronic navigation charts for the Project Area, including provision of relevant computer software licenses to the Republic of Indonesia and to Malaysia.
4. Information Exchange System. Establishment of a MEH information exchange system, including data servers, data exchange protocols and training of staff in data exchange.

### **Component 3: Ship-board Equipment and Communications (US\$6.00 million)**

Carrying out of testing of the demonstration MEH system by about 160 ships fitted with type-approved electronic chart display and information systems, including internet connectivity. This component will be executed by the owners of at least 160 large oil tankers and container ships that regularly transit the Straits, and will be facilitated by two major ship owner representative organizations, the International Association of Independent Tanker Owners (INTERTANKO) and the International Chamber of Shipping (ICS). With the facilitation of INTERTANKO and ICS, the ship owners will arrange that, by the end of year three, at least 160 of their ships that regularly transit the Straits are fitted with internationally-approved Electronic Chart Display and Information System and Automatic Identification System and have internet connectivity—these elements comprise the suite of technical equipment required to use all the elements of the MEH demonstration system. In addition, the ship owners will ensure that, once the MEH demonstration system is operational, all of the 160 ships which are so equipped always use it when transiting the Straits and provide detailed and timely feed-back on its performance to the PMO and later to the independent experts tasked with evaluating the demonstration system and

assessing the costs, benefits and legal/financial feasibility of expanding it to cover the entire Straits (see Component 5).

#### **Component 4: Marine Environment Protection (US\$0.85 million)**

This component will be executed jointly by the institutions in the littoral states that are responsible for marine navigation and environmental management and the International Maritime Organization and will consist of the following activities:

1. Oil Spill and Sand Wave Models. Carrying out of a modeling and analyses of: (i) the likely movement of oil spills originating in the Project Area, and (ii) the sand wave formation and movement in the Project Area.
2. Sensitive Area Mapping. Research and development of options for providing real-time geo-referenced environmental protection information to mariners navigating in the Straits of Malacca and Singapore and for conservation and coastal resources management and mapping of sensitive areas.
3. Emergency Response Systems. Carrying out of simulated oil and chemical spill emergency response exercises to determine the cost-effectiveness and efficiency of the MEH system in the event of chemical and oil spill incidents from ships.

#### **Component 5: Information Dissemination, Evaluation and Scale-Up Plan (US\$0.23 m)**

This component will be managed by the IMO through the PMO, and will produce the following outputs:

1. Website and Publicity. Production and dissemination of information through the Internet on the MEH system, including technical reports, progress reports and a newsletter, and carrying out of national and regional workshops and seminars to provide information and seek feedback on the benefits and applicability of the MEH system.
2. Evaluation. (a) Assessment of the cost and benefits of the establishment and use of the MEH system in terms of maritime safety and marine environment protection, including (i) the development of criteria and measurable indicators for the socio-economic assessment of the MEH system, and (ii) the carrying out of a socio-economic survey to evaluate the benefits of the MEH system; (b) (i) Carrying out of an assessment of the technical functionalities of the MEH system, including system performance, (ii) Carrying out of a continuous monitoring of new and potential technologies that could be linked to the MEH system or enhance its performance, including the carrying out of technical evaluations on the new technologies to determine their suitability, value added contribution, enhancing performance and cost effectiveness, (c) Carrying out of an assessment of the MEH system, including institutional and legal aspects, and (d) Consolidation of the technical, institutional, legal, financial and economic assessments of the MEH system, including the implementation of the Project, and development of a managing tool blueprint.

3. System Development. Carrying out of marketing strategies to package and market the MEH system and its marine information and other products, and the services it could provide.

## **5. Lessons learned and reflected in the project design**

The concept of a Marine Electronic Highway (MEH) was initiated in Canada in the early 1990s with the application of digital technology to navigation, particularly in the development of Electronic Navigation Charts (ENCs) and the Electronic Chart Display and Information Systems (ECDISs). The core of the Canadian version of the MEH was the integration and interconnection of the ECDIS and the Automatic Identification System with powerful shore-based databases to provide a basis for optimized shipping traffic management decisions.

Since 1995, the ECDIS has been widely deployed in Canada in the Great Lakes and the St. Lawrence River corridor with considerable success, especially in assisting with navigating through treacherous waters even in heavy fog conditions. However, standards for ENCs and the unavailability of type-approved ECDIS during this early period led to the use of non-conforming ECDIS by the Canadian shipping sector. Thus, many Canadian ships plying the Great Lakes and the St. Lawrence Seaway had difficulty in switching to standardized technology subsequent to the commercial launching of the first type-approved ECDIS in 1999, and the wider adoption of the International Hydrographic Organization's S-57 (electronic chart standard). Although the full MEH concept remains to be realized, the pioneering efforts in Canada have led to the widespread adoption of ENCs and the ECDIS. Since 1999, several type-approved ECDIS have appeared on the market, and many national hydrographic agencies have the capacity to produce approved S-57 electronic navigation charts.

The utility of ENCs combined with ECDIS is now well accepted in the maritime industry as a means to increase the safety of vessels and improve their commercial performance, particularly in areas with restricted under keel clearance and water depth. Placing these technologies in the framework of the MEH system will provide greater benefits not only for the shipping industry but also for the marine environment sector. From the marine environment protection standpoint, the reduction of vessel accidents and online availability of marine information could lead to improved monitoring and lower response time to marine environmental incidents, and lower clean-up costs and better quantification of damages, as well as enhanced management of the coastal and marine resources in the Straits.

## **6. Alternatives considered and reasons for rejection**

The alternative of making incremental improvements to existing navigational facilities and ship control systems in the Straits was considered but rejected because it has very limited potential for reducing ship-related environmental damages or for improving navigational efficiency compared with the proposed MEH system.

New technology is now under development that would enhance the value of the MEH. This technology involves using real time satellite monitoring of the sea bed and depth of water, with accuracy to within one meter. This, along with the application of real time tide and weather

information to mathematical models, would give vessel operators a much higher level of confidence to load their ships with a reduced under keel clearance than an estimate of the available water depth based on hydrographic surveys. However this technology is not yet proven and its cost is unknown. The concept of the MEH is to make maximum use of available technology and not use it as an experimental application of new technology. Although new technologies have been rejected for now, their development will be monitored during the MEH Demonstration Project and their viability reassessed before design of the Full-Scale MEH project.

## **C. IMPLEMENTATION**

### **1. Partnership arrangements**

The demonstration phase of the Project will be managed by the International Maritime Organization, a United Nations organization with a global mandate for navigation safety and marine environmental protection. The governments of the Republic of Indonesia, Malaysia and Republic of Singapore have signed a *Memorandum of Understanding* that defines their relative responsibilities under the project. Other partners in the project, that have signed a *Memorandum on Arrangements*, are INTERTANKO (representing the owners of tanker vessels using the Straits), the International Chamber of Shipping representing the interests of owners of container vessels using the Straits, and the International Hydrographic Organization, the intergovernmental organization with responsibility for the quality of hydrographic information included in marine charts. Discussions are under way with other national governments that have expressed an interest in participating in the Project.

### **2. Institutional and implementation arrangements**

The Project Steering Committee (PSC) established during the project preparation will continue to act as the overall regional body to implement the MEH Demonstration Project. The three littoral states of Indonesia, Malaysia and Singapore are permanent members of the PSC. The PSC will participate in the annual GEF Project Implementation Review.

There are two grants to support the MEH project. The International Maritime Organization is the Recipient of a US\$6.86 million Grant and will be responsible for the management of the project and all components except the sub-component on tide and current facilities. The second Grant is to the Republic of Indonesia for US\$1.44 million. The Office of the Deputy Minister for Nature Conservation Enhancement and Environmental Destruction Control of the Ministry of Environment is the coordinating Ministry for the Indonesian part of the Project. The Directorate General of Sea Transport of the Ministry of Transport is the implementing agency. A Project Management Office will be established to administer and manage the project on site. It will be sited in Batam in Sumatra, Indonesia and will be hosted by the Republic of Indonesia.

### **3. Monitoring and evaluation of outcomes/results**

The objective of the Marine Electronic Highway (MEH) Demonstration Project is to determine whether the Full-Scale MEH will be technically, politically, operationally, and financially viable. Monitoring and evaluation of the progress and outcomes of the MEH Demonstration Project will be an important contribution to a decision whether to proceed with the Full-Scale MEH. In addition, there will be a mid-term review and annual reviews by the Project Steering Committee (PSC), bi-annual internal reviews on project implementation as well as the results and outputs. The PSC will participate in the annual GEF Project Implementation Review. The findings of these reviews will be used to assess project progress and the need to modify approaches and the mobilization of resources.

The key performance indicators as shown in Annex 3 will be used to assess the outputs and impacts of the MEH Demonstration Project.

The Project Management Office (PMO) will be responsible for preparing terms of reference, contracting and supervising the consultants who will undertake the basic monitoring and evaluation tasks. One of the main results of the MEH Demonstration Project will be an assessment of the viability of the Full-Scale MEH and of the conditions necessary for its successful implementation and operation. Although the assessment will be made by consultants contracted by and working under terms of reference prepared by the PMO, it is the PSC that will have final responsibility for all conclusions of the monitoring and evaluation studies.

### **4. Sustainability and Replicability**

Although the Full-Scale MEH system is limited to the area of the Straits of Malacca and Singapore, there is an intention that the scope should be extended to the whole of the sea-lanes between the Suez Canal and the major ports of East Asia. There are other sea lanes with a high density of shipping where the principles of the MEH could be applied, including the Black Sea and Bosphorus, the Baltic Sea, the North Sea and English Channel, the River Plate, the Red Sea, the approaches to the Panama Canal and the St. Lawrence Seaway (where the concept of a MEH was first applied).

### **5. Critical risks and possible controversial aspects**

The MEH Demonstration Project's risks to the development and establishment of the Full-Scale MEH are that the private sector will not be willing to commit, finance and implement the activities designed to develop and establish the MEH system, as well as the lack of commitment from governments to engage in such partnership arrangements. However, the implementation of the two stages of the MEH means that ample time and effort will be provided for the development and establishment of the Full-Scale MEH.

<b>Potential risks</b>		<b>Risk Mitigation</b>	<b>Rating</b>
<i>Political</i>	This is a multi-national project, requiring cooperation among states that have not been consistent in maintaining such relations. In addition, the MEH covers international waters, where the authoritative institution is the IMO. The activities of shipping in international waters are subject to a large number of conventions and agreements that are administered by the IMO, however it has few powers of enforcement of these, other than by persuasion and cooperation with industry.	During the Project preparation phase, the three states involved in the Project have demonstrated a high level of cooperation and coordination of their respective activities. Their commitment, as well as the commitment of all other participating organizations, is further codified in the <i>Memorandum of Understanding</i> and the <i>Memorandum on Arrangements</i> , which have been signed by all parties concerned. Other agreements will be developed in the course of project implementation, which will cover partnerships with various agencies, organizations and groups to carry out specific activities under the five Project components. These agreements will spell out the specific commitments of each of the parties whose participation is essential to the success of the Project.	S
<i>Managerial</i>	The MEH Demonstration Project will involve a large number of agencies, the procurement of a large volume of highly sophisticated equipment and the integration of several different technologies.	The required managerial capacity and experience will be provided by the IMO as project manager. The strength of the IMO in this role was demonstrated during the Project preparation phase, as well as in numerous similar projects that depend on international cooperation of a group of maritime littoral states in their mutual interest. The day-to-day management of the Project will be provided by a specially recruited project management team under the supervision of IMO and guidance of the Project Steering Committee including the four Technical Committees and two <i>ad hoc</i> Working Groups.	M
<i>Technical</i>	The MEH Demonstration Project is the first to implement a coordinated set of marine operational and environmental tools and as such is subject to the risks associated with such demonstration projects, with the principal technological risk being in the provision of the needed software and models.	Since the required software and associated models does not involve any new or innovative technology, this risk is considered minimal and not exceptional for a project based on electronic procedures.	M
<i>Financial</i>	The Project is fully dependent on support from the shipping industry and, in particular, on the willingness of the ship operators who make most use of the Straits of Malacca and Singapore to accept MEH-user charges and to invest in equipping their vessels to use the MEH.	The three littoral states, INTERTANKO and ICS have already committed to their financial contribution and these commitments have been confirmed in the MOU and the MOA, respectively. INTERTANKO and ICS have committed that their members will supply at least 60 and 100 respectively, adequately equipped vessels. On-going consultations with representatives of other shipping interests will be maintained in the expectation that further commitments to equipping ships to participate in the demonstration project will be made. Importantly, owners will continue to have the choice of not using the MEH and passing the Straits completely, free of any charges.	M
		The cost of the MEH Demonstration Project may exceed the estimates in this Project Appraisal Document. Korea and Japan have already expressed an interest in contributing expert personnel, equipment, and/or financial resources for the Project.	S
<b>Overall Risk Rating</b>			<b>M</b>

Risk Rating – H (High Risk), S (Substantial Risk), M (Modest Risk), N (Negligible or Low Risk)

## **6. Grant conditions and covenants**

### **6.1 Grant Agreement with the International Maritime Organization**

#### **Condition of Board Presentation**

The International Maritime Organization (IMO) and the Republic of Indonesia have concluded a Memorandum of Agreement, acceptable to the Bank, specifying the functions; staffing, including support staff; facilities including office space to be provided to the Project Management Office in Batam, as well as who will provide the required staff, facilities, and operating costs.

#### **Conditions of Effectiveness**

- (a) The Global Environment Facility Trust Fund Grant Agreement shall have been executed on behalf of the Republic of Indonesia and the Bank.
- (b) The IMO shall have provided to the Bank a Project management memorandum, acceptable to the Bank.
- (c) The Project Implementation Plan, acceptable to the Bank, shall have been adopted by the IMO and endorsed by the Republic of Indonesia, Malaysia and the Republic of Singapore.

#### **Conditions for Continued Implementation**

- 1. The IMO shall take all steps necessary to ensure that the Project Steering Committee shall be maintained until completion of the Project.
- 2. The IMO shall, in accordance with the provisions of the Memorandum of Agreement, establish by December 31, 2006, and, thereafter, maintain until the completion of the Project, the Project Management Office, with term of reference and staff and at all times acceptable to the Bank, including a Project Manager.
- 3. The IMO shall, until completion of the Project, maintain at its headquarters a procurement officer, acceptable to the Bank.
- 4. The IMO shall prepare and furnish to the Bank a Project management memorandum, acceptable to the Bank, setting forth the management tasks to be carried out by the Recipient under the Project, including the estimated cost of each task.
- 5. The IMO shall adopt and, thereafter apply in the implementation of the Project, the Project Implementation Plan, acceptable to the Bank, which shall include the description of: (a) implementation arrangements, (b) the procurement procedures set forth in the Grant Agreement and standard procurement documentation, (c) reporting requirements, financial management procedures and audit procedures as set forth in the Grant Agreement, (d) the Project Performance Indicators set forth in the Grant Agreement, and shall not amend, suspend, abrogate, repeal or waive any provisions of the Project Implementation Plan without the prior agreement of the Bank.
- 6. The IMO shall cause the Project Steering Committee to:
  - (a) furnish to the Bank for its review and comments not later than September 30 in each year, commencing September 30, 2007, and until completion of the Project, draft revisions to the Project Implementation Plan for the components of the Project not yet carried out, with emphasis on the activities to be carried out in the following calendar year, including

- the scope of the activities to be carried out, cost estimates, time based implementation schedules, financing plan, budget arrangements, and the relevant procurement plan; and
- (b) finalize the revised Project Implementation Plan by November 30 in each year, commencing November 30, 2007, taking into account the comments of the Bank thereon.
7. In carrying out Component 2.3 of the Project, the IMO shall provide all required technical assistance to the Republic of Indonesia, Malaysia and the Republic of Singapore to ensure the production of the electronic navigational charts by March 31, 2008.
  8. In carrying out Component 3 of the Project, the IMO shall provide the required technical assistance to ensure that the International Association of Independent Tanker Owners and the International Chamber of Shipping have each, by December 31, 2008, at least 60 and 100 ships, respectively, equipped with type-approved electronic chart display and information systems, including internet connectivity.
  9. In carrying out Component 5 of the Project, the IMO shall:
    - (a) by May 31, 2010, furnish to the Bank the draft final report on the technical, financial, economic, and legal feasibility of a scaled-up Marine Electronic Highway system for the entire Straits of Malacca and Singapore; and
    - (b) by August, 2010, taking into account the comments of the Bank, furnish to potential participants and beneficiaries of the full-scale Marine Electronic Highway system the finalized feasibility study, including the design of an operational and financing plan and an institutional structure for the scaled-up Marine Electronic Highway system.
  10. The IMO shall:
    - (a) maintain policies and procedures adequate to enable it to monitor and evaluate on an ongoing basis, in accordance with the indicators set the Grant Agreement, the carrying out the Project and the achievement of the objectives thereof;
    - (b) prepare, under terms of reference satisfactory to the Bank, and furnish to the Bank, on or about June 30 of each year, commencing June 30, 2007, a report integrating the results of the monitoring and evaluation activities performed pursuant to the Grant Agreement on the progress achieved in the carrying out of the Project during the period preceding the date of said report and setting out the measures recommended to ensure the efficient carrying out of the Project and the achievement of the objectives thereof during the period following such date; and
    - (c) review with the Bank, by September 30 of each year, commencing September 30, 2007, or such later date as the Bank shall request, the report referred to the Grant Agreement, and, thereafter, take all measures required to ensure the efficient completion of the Project and the achievement of the objectives thereof, based on the conclusions and recommendations of the said report and the Bank's views on the matter.
  11. The IMO shall:
    - (a) prepare, under terms of reference satisfactory to the Bank, and furnish to the Bank, on or about September 30, 2008, a report integrating the results of the monitoring and evaluation activities performed pursuant to the Grant Agreement, on the progress achieved in the carrying out of the Project, including an assessment of the commitment of the partners in the Project, the interest of other countries in the scaled-up marine electronic highway, evaluation of new technologies and their potential applicability and inclusion in the marine electronic highway, and determination of the need for Project restructuring, if any.

(b) review with the Bank and with the parties to the Memorandum on Arrangements, by December 31, 2008, the report referred to in the Grant Agreement, and, thereafter, take all measures required to ensure the efficient completion of the Project and the achievement of the objectives thereof.

## **6.2 Grant Agreement with the Republic of Indonesia**

### **Condition of Board Presentation**

The International Maritime Organization (IMO) and the Republic of Indonesia have concluded a Memorandum of Agreement, acceptable to the Bank, specifying the functions; staffing, including support staff; facilities including office space to be provided to the Project Management Office in Batam, as well as who will provide the required staff, facilities, and operating costs.

### **Conditions of Effectiveness**

- (a) The GEF Trust Fund Grant Agreement shall have been executed on behalf of the International Maritime Organization and the Bank.
- (b) The Project Coordination Unit shall have been established
- (c) The Project Implementation Unit shall have been established
- (d) The Republic of Indonesia shall have established auditing arrangements, acceptable to the Bank, including provisions to make the audit report available to the public.
- (e) The Project Implementation Plan, acceptable to the Bank, shall have been adopted by the Republic of Indonesia.

### **Conditions for Continued Implementation**

- 1. The Republic of Indonesia shall, until completion of the Project, remain a member of, and an active participant in, the Project Steering Committee.
- 2. The Republic of Indonesia shall, in accordance with the Memorandum of Agreement, cause to be established by December 31, 2006, and, thereafter, maintained until the completion of the Project, the Project Management Office, with facilities and support staff at all times acceptable to the Bank.
- 3. The Republic of Indonesia shall establish, and thereafter maintain until completion of the Project:
  - (a) the Project Coordination Unit with terms of reference, facilities and staff at all times acceptable to the Bank; and
  - (b) the Project Implementation Unit with term of reference, facilities and staff, including a procurement officer and a financial officer, at all times acceptable to the Bank.
- 4. The Republic of Indonesia shall adopt and, thereafter, apply in the implementation of the Project, the Project Implementation Plan, acceptable to the Bank, which shall include the description of: (a) implementation arrangements, (b) the procurement procedures set forth in the Grant Agreement and standard procurement documentation, (c) reporting requirements, financial management procedures and audit procedures as set forth in the Grant Agreement, (d) the Project Performance Indicators set forth in the Grant Agreement, and shall not amend, suspend, abrogate, repeal or waive any provisions of the Project Implementation Plan without the prior agreement of the Bank.

5. In carrying out Component 2.1 of the Project, the Republic of Indonesia shall, not later than April 30, 2007, complete the purchase and installation of new tidal stations and the upgrading of existing tidal stations.
6. The Republic of Indonesia shall:
  - (a) maintain policies and procedures adequate to enable it to monitor and evaluate on an ongoing basis, in accordance with the indicators acceptable to the Bank, the carrying out of Component 2.1 of the Project and the achievement of the objectives thereof;
  - (b) prepare, under terms of reference satisfactory to the Bank, and furnish to the Bank, on or about June 30 of each year, commencing June 30, 2007, a report integrating the results of the monitoring and evaluation activities performed pursuant to paragraph (a) of this Section, on the progress achieved in the carrying out of Component 2.1 of the Project during the period preceding the date of said report and setting out the measures recommended to ensure the efficient carrying out of Component 2.1 of the Project and the achievement of the objectives thereof during the period following such date; and
  - (c) review with the Bank, by October 1 of each year, commencing October 1, 2007, or such later date as the Bank shall request, the report referred to in the Grant Agreement, and, thereafter, take all measures required to ensure the efficient completion of Component 2.1 of the Project and the achievement of the objectives thereof, based on the conclusions and recommendations of the said report and the Bank's views on the matter.

## **D. APPRAISAL SUMMARY**

### **1. Economic and financial analyses**

The Full-Scale Marine Electronic Highway (MEH) system has a very high economic rate of return, with a pay-back period of less than one year. The probable savings in ship operating costs in the first year of operation are several times greater than the total investment cost of the project. Even when the annual operating and maintenance costs and future investment costs in new hydrographic surveys are included, the economic rate of return is in excess of 100 percent (details in Annex 9). This indicates that the cost savings to ship operators in the first year of operation of the project are expected to exceed the total investment costs.

No financial analysis has yet been carried out, since the financial feasibility of the Full-Scale MEH is one of the activities to be undertaken during this MEH Demonstration Project. The financial feasibility depends on the operators of ships, who will benefit from the reduced under-keel requirements of the Straits, being prepared to pay for the service that will enable them to take advantage of the reduced clearance.

### **2. Technical**

From a technical standpoint, the critical aspects in the development of the MEH system will be the integration of maritime safety technologies, marine environment protection systems and the establishment of the managing tool (the full Technical Specifications of the MEH in the Straits of Malacca and Singapore is available in the project file). The risk associated with project implementation could be minimized by identifying and addressing the technical, socio-economic, financial and legal issues and by quantifying and promoting the benefits of the MEH system.

The process will be a participatory approach and this will provide the opportunity for the relevant stakeholders to own the development of the MEH system and propel it to its completion. The co-operation initiated during the project preparation (PDF Block B phase) will be strengthened by the participatory approach and serve as an impetus to stronger public-private sector partnership and broader clientele (littoral States, user States, the private sector and technology providers and users).

### **3. Fiduciary**

*Financial Management (Annex 7).* From a financial management perspective, the MEH Demonstration Project is considered a low risk project. The financial management arrangements for the MEH Demonstration Project activities implemented by the International Maritime Organization (IMO) are acceptable. As a specialized agency of the United Nations, the IMO follows acceptable accounting and reporting practices in accordance with the United Nations System Accounting Standards. IMO received an unqualified opinion on its most recent financial statements. IMO is a reputable United Nations agency with extensive experience in implementing donor-financed projects. The nature of the Project procurement (i.e., a relatively few contracts, each large in size) and resulting simplified accounting and reporting also contribute to the low risk rating. Since about 15-20 percent of the grants will be used for the procurement of equipment, physical inspection to confirm the proper use of Project funds will be possible.

For the Republic of Indonesia component the Ministry of Transport will assign its own staff as the financial officer for the Project, who will support the preparation of the Project interim un-audited financial statement of the Project on quarterly basis. The payment verification will be conducted under the finance unit of Directorate General Sea Transport of Ministry of Transport.

*Procurement (Annex 8).* A Procurement Capacity Assessment has been conducted as part of the project preparation in accordance with the Revised Instructions for carrying out Assessment of Agency's Capacity Assessment to Implement Procurement (2002). The objective is to evaluate the capability of the implementing agencies and the adequacy of the procurement and related systems in place, assess the risks, develop an action plan to enhance capacity and minimize risks, and, to propose a suitable supervision plan (the full Procurement Capacity Assessment is available in the project file).

The International Maritime Organization (IMO) is responsible for the US\$6.86 million Grant and will undertake procurement of goods and consultancy packages and provide overall management of the Project for the three littoral states. The IMO system is established and functioning in accordance with the applicable United Nations rules and regulations.

The Republic of Indonesia is responsible for the US\$1.44 million Grant. The Office of the Deputy Minister for Nature Conservation Enhancement and Environmental Destruction Control of the Ministry of Environment is the coordinating Ministry for the Project. The Directorate General of Sea Transport (DGST) of the Ministry of Transport is the implementing agency and will undertake all the procurement required for Indonesian part of the Project, namely four goods packages (Tidal Stations, DGPS Base Station, two AIS Base Stations, and Ocean Buoys).

The Assessment rated the project risk as “*average*” due to the following identified aspects: (i) procurement activities consist of a limited number of packages, about nine goods procurement and about 19 consultancy services; (ii) six of the packages for procurement of goods and non consulting services will be conducted through international competitive bidding and three packages will be procured through shopping procedures; and (iii) Technical Committees will be established, with representatives of each of the implementing agencies, who will prepare the specifications of the procurement packages.

The actions to mitigate the risks include: (i) the prior review thresholds are set lower than the maximum thresholds for average risk projects; (ii) the Procurement Plan for the Project has been established and will be updated when necessary; (iii) a Procurement Officer will be appointed in MOT and the Officer in charge of procurement within IMO will provide coordination and management of procurement activities; (iv) all the technical specifications and bidding documents will be prepared well in advance of procurement implementation by the IMO and MOT; and (v) a set of disclosure policies to increase public accountability of the Project will be adopted.

#### **4. Social**

The Project is expected to generate coastal development and environmental benefits for the littoral states; global environment benefits by reducing the pollution of shared marine water bodies; and economic benefits for the international shipping industry and their billions of customers. It will further result in reduced vulnerability to catastrophic pollution for the coastal states and the communities depending on the Straits’ marine and coastal resources for their livelihoods. The technological innovations associated with the Project’s implementation and its information generation and sharing aspects, in particular, are expected to significantly contribute to improved environmental stewardship and natural resource management capacity across the three littoral states. No direct or indirect adverse social impacts are expected.

#### **5. Environment**

To the extent that no direct or indirect adverse impacts to the environment are associated with this Project, it has been classified as an environmental category “C” project. The Project is expected to have important positive environmental impacts on the Straits and the coastline of the littoral states. The approach proposed under the Project will seek to significantly reduce marine pollution risks and pressures in the Straits’ area in a way that is environmentally sustainable. Moreover, as an integral part of the Marine Electronic Highway (MEH) architecture an Environmental Management and Protection System (EMPS) will be designed and implemented for the demonstration area.

The EMPS component of the MEH system is an amalgamation of several models and systems. This MEH Demonstration Project will evaluate several EMP models and systems for integration into the MEH system including meteorological, oceanographic and environmental information systems. The EMPS that will be evaluated are: (i) a 3-Dimensional hydrodynamic model; (ii) an oil spill trajectory and fate model; (iii) coastal and ocean monitoring systems (e.g., tides and current); (iv) environmental impact assessment; (v) an oil spill damage assessment model; (vi)

sensitivity mapping, and; (vii) static and dynamic environmental information integration into ENC/ECDIS. The ENCs that will be produced from the hydrographic survey using multi-beam technology will be used as base maps for these models including the sensitivity mapping. Moreover, through the piloting of environmental marine information objects to supplement the Straits' ENC, the project will not only provide mariners with key pollution prevention information but will also provide access to key geo-spatial information to conservationists and resource managers.

Existing models and systems in use by relevant authorities of the littoral States for marine pollution prevention and response, environmental monitoring and coastal resource management will be evaluated and harmonized for incorporation into the MEH system as appropriate. New models and systems will also be included such for sand waves monitoring and chemical spill response. Aside from the technical evaluation of the EMPS, related activities in other components will be implemented to promote the participation of relevant stakeholders in the environmental sector in the Project and also to ensure long term utility of the MEH system for marine environment protection. Importantly, to the extent that such an effort entails bringing together mariners, hydrographers, conservationists, scientists and resource managers, it will enhance the open flow of marine geo-spatial information to environmental conservation and resource management applications.

## 6. Safeguard policies

<b>Safeguard Policies Triggered by the Project</b>	Yes	No
<a href="#">Environmental Assessment (OP/BP/GP 4.01)</a>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Natural Habitats ( <a href="#">OP/BP 4.04</a> )	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Pest Management ( <a href="#">OP 4.09</a> )	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Cultural Property ( <a href="#">OPN 11.03</a> , being revised as OP 4.11)	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Involuntary Resettlement ( <a href="#">OP/BP 4.12</a> )	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Indigenous Peoples ( <a href="#">OD 4.20</a> , being revised as OP 4.10)	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Forests ( <a href="#">OP/BP 4.36</a> )	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Safety of Dams ( <a href="#">OP/BP 4.37</a> )	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Projects in Disputed Areas ( <a href="#">OP/BP/GP 7.60</a> )*	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Projects on International Waterways ( <a href="#">OP/BP/GP 7.50</a> )	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Although the Project triggers [OP/BP/GP 7.50](#), Projects on International Waterways, the requirement of notification of other riparians does not arise. This is because the three littoral states of the Strait of Malacca, namely Republic of Indonesia, Malaysia and Republic of Singapore, are participating in the implementation of the Project, and are indeed the beneficiaries of the Project and have signed a *Memorandum of Understanding* regarding their participation.

## 7. Policy Exceptions and Readiness

The Project does not require any exceptions from Bank policies. The Project meets the Bank's criteria for readiness for implementation.

\* By supporting the proposed project, the Bank does not intend to prejudice the final determination of the parties' claims on the disputed areas

## **Annex 1: Country and Sector or Program Background**

### **Marine Electronic Highway Demonstration Project**

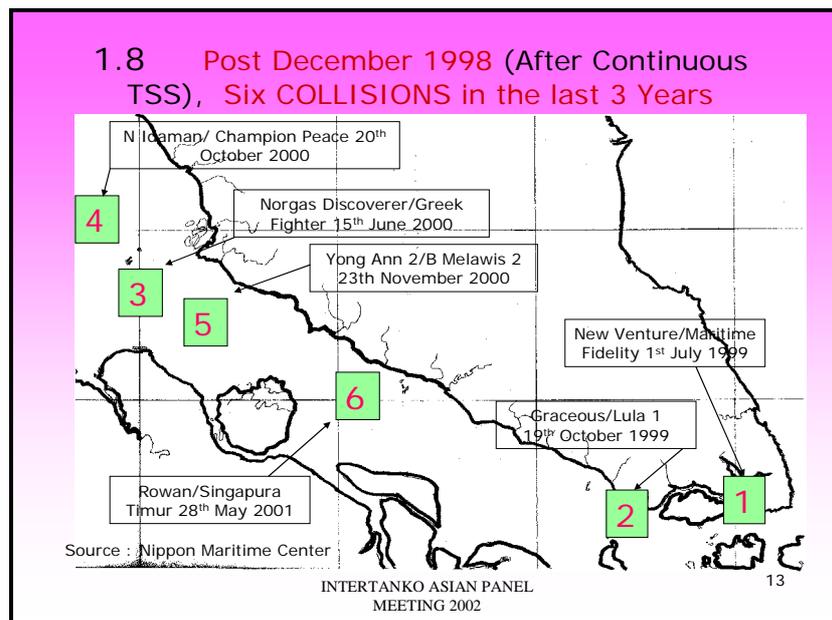
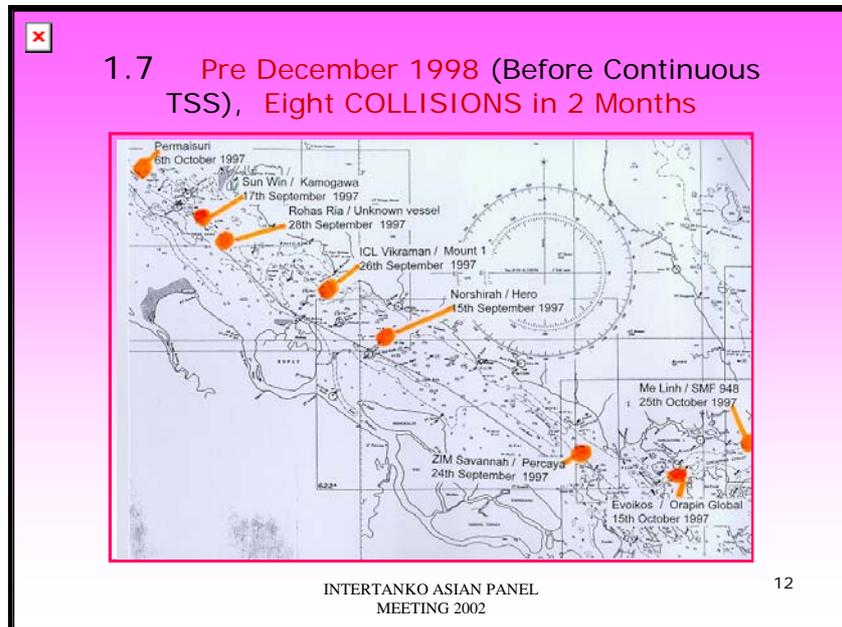
The Straits of Malacca and Singapore are relatively shallow, hazardous to navigation, and characterized by narrow channels, irregular tides and shifting bottom topography. The Straits are also of global marine biodiversity significance, rich in the marine fauna and flora that characterize tropical estuarine environments. Abundant sea grass beds, mangroves, coral reefs and wetlands enrich the associated coastal marine environments, which are also stopover points for migratory birds on seasonal transition. Marine natural resource-related activities such as fishing and coastal tourism are very important sources of income for the millions of people living in the coastal zone.

The Straits are also the preferred international route for the majority of ships en route between the Persian Gulf and the Far East, mainly because the two alternative routes (the Lombok-Makassar and Sunda Straits) add several days to the voyage. Recent enhancements in maritime safety infrastructures and regulatory mechanisms in the Straits have improved navigational safety, vessel traffic flow and the overall management of the Straits as a major international sea lane. However, the volume of international traffic passing through the Straits or calling at its ports is very heavy for such a confined and environmentally sensitive waterway and is increasing steadily. In 2001, 146,265 vessels (>75 gross tons) called at the port of Singapore. Vessel arrivals from 1995 to 2001 increased by an average of 6 percent per year for the Port of Singapore and 11 percent for Port Klang in Malaysia. There is also substantial volume of cross-Straits traffic between the three littoral States for trade and fishing. Notwithstanding the current navigation system, the risk of ship collisions and groundings and of consequent environmental and economic damage is high.

Ship-based sources contribute 20 percent of the marine pollution in the Straits and have acute impacts on it. The major pollutants from ships are oil, chemicals, liquefied gases, sewage, garbage, bilge water, ballast water and antifouling paints. The biggest concern is a catastrophic oil spill due to collision and/or grounding of a very large tanker, thousands of which pass through the Straits each year. An oil spill can cover a vast area of the sea's surface, as well as neighboring beaches, and its damage can be considerable. The cost of cleaning-up an oil spill is very high and its environmental impact on living resources, particularly sea birds and near-shore sessile organisms, is significantly detrimental.

Despite recent incremental improvements to existing navigational aids and facilities in the Straits of Malacca and Singapore that have reduced the incidence of ship collisions and grounding or of chemical and oil spills (see Figure A1), there is still room for improvement. Although risk assessment of tankers in the Straits based on tanker accidents in the period from 1982 to 1993 showed a relative constant risk at 0.029 percent (Malacca Straits: refined risk assessment, GEF/UNDP/IMO Regional Program, 1999) a steady number of serious vessel accidents have occurred in recent years, such as the 'Natuna Sea' (October 2000) and 'Singapura Timur' (May 2001). Total compensation claims for the 'Natuna Sea' from the three littoral States were over US\$127 million, but only 8.48 percent was paid due to unsubstantiated and disallowed claims, especially on environmental and fishery-related damage.

## Reduction in accident rate following implementation of the Traffic Separation Scheme



Although the three littoral States of Republic of Indonesia, Malaysia and Republic of Singapore have relatively good oil spill response capabilities, including oil spill contingency plans and response facilities and a cooperative response agreement, several recent serious shipping accidents have highlighted the need for quicker and better targeted deployment of spill response equipment and manpower and more efficient institutional arrangements. Immediate access to information on resources at risk, on spill location, and on the locations of stockpiled response equipment would also raise the effectiveness and efficiency of an oil spill response.

## Annex 2: Major Related Projects Financed by the Bank and/or other Agencies

### Marine Electronic Highway Demonstration Project

<i>Sector issue</i>	<i>Project</i>	<i>Latest supervision ratings (Bank/GEF-financed projects only)</i>	
		Implementation progress	Development objective
<b>Bank/GEF financed</b>			
Protection of international waters from ship oil spills and ship ballast water pollution	Oil Pollution Management for the South-west Mediterranean Sea (TF028650 - Algeria, TF028651 - Morocco and TF-028652 - Tunisia) closed March 2001	Satisfactory	Satisfactory
Protection of international waters from ship oil spills; ship navigational safety	Western Indian Ocean Oil Spill Contingency Planning (Comoros, Seychelles, Madagascar, Mauritius) TF021424 closed January 2006	Satisfactory	Satisfactory
Protection of international waters from ship oil spills and ballast water pollution; ship navigational safety	Western Indian Ocean Marine Highway Development and Coastal and Marine Contamination Prevention (under preparation)		
Protection of international waters from ship oil spills; ship navigational safety	Argentina: Coastal Contamination Prevention and Sustainable Fisheries Management TF028385 (expected to close in December 2006)	Satisfactory	Satisfactory
Environmentally-sound disposal of ship wastes	China Ship Waste Disposal TF028613 closed April 1998	Satisfactory	Satisfactory
Environmentally-sound disposal of ship wastes	Caribbean Ship-Generated Waste Management closed	Unsatisfactory	Unsatisfactory
<b>Other agencies</b>			
Protection of marine resources and regional environmental legislation	Intergovernmental Oceanographic Commission Regional Environment Program		
Protection of international waters ship-based pollution	Intergovernmental Oceanographic Commission Regional Action Project for Maritime Security		
Protection of international waters from ship-based pollution	Inter-American Development Bank Environmental Protection and Maritime Transport Pollution Control in the Gulf of Honduras (under preparation)		
Protection of international waters from ship-based pollution	IMO/GEF/UNDP Global Ballast Water Management Program		

**Annex 3: Results Framework and Monitoring**  
**Marine Electronic Highway Demonstration Project**

<b>Project Development Objective/ Global Environment Objective</b>	<b>Outcome Indicators</b>	<b>Use of Outcome Information</b>
<p>Project Development Objective is to assist the Republic of Indonesia, Malaysia, the Republic of Singapore and representatives of some of the large commercial ship owners that use the Strait of Malacca and the Strait of Singapore, to collectively decide whether to establish a marine electronic highway for the entire length of the Straits of Malacca and Singapore.</p> <p>Global Environment Objective is to improve maritime safety and reduce environmental damage to the globally-significant shared natural resources of the Straits of Malacca and Singapore.</p>	<p>The littoral states and commercial shipping users of the Straits jointly decide whether or not to develop a Marine Electronic Highway (MEH) for the entire Straits and an Environment Fund, based on evaluation of this MEH Demonstration Project and a cost/benefit and financial/legal feasibility analysis of a potential Full-Scale MEH system for the entire Straits.</p> <p>If their decision is positive, a full-scale MEH for the entire Straits of Malacca and Singapore and an Environment Fund are designed and a financing and institutional plan prepared.</p>	<p>Year 4 - Surveys of littoral states' and ship users' initial satisfaction with the demonstration system are used to refine it.</p> <p>Year 5 – If stakeholders express serious interest in developing Full-Scale MEH for the entire Straits, prepare technical design, institutional arrangements and financing plan.</p>
<b>Intermediate Results One per Component</b>	<b>Results Indicators for Each Component</b>	<b>Use of Results Monitoring</b>
<p><b>Component One:</b> Development and evaluation of a demonstration MEH system for the most congested 300 kilometer section of the Straits of Malacca and Singapore is well coordinated, managed and technically supported.</p>	<p><b>Component One:</b> PIPs prepared and implemented on schedule and updated annually, financial management system effective, disbursements on schedule.</p> <p>All partners report project management system is functioning effectively.</p> <p>Four MEH data centers established. Data production and management system functioning satisfactorily.</p> <p>MEH demonstration system for congested 300 kilometer section of the Straits fully functional.</p>	<p><b>Component One:</b> Year 1 – Slow PIP execution and/or project management problems indicate need to assess adequacy of and if necessary upgrade Project Management Office (PMO) facilities, staffing or partner collaboration mechanisms.</p> <p>Year 2 – Progress guides performance assessment of all PMO members and PMO staff hiring/retention decisions.</p> <p>Years 3/4 – Project completion timetable adjusted, if necessary.</p>
<p><b>Component Two:</b> Clear, accurate and user-friendly Electronic Navigation Charts (ENCs) are produced for the Straits of Malacca and Singapore and are made available to ships transiting it that have the necessary</p>	<p><b>Component Two :</b> Indonesian navigational data gathering system in Straits upgraded and data provided to MEH PMO.</p> <p>Hydrographic survey of MEH area</p>	<p><b>Component Two:</b> Year 2 – Failure to obtain required information indicates monitoring and communications equipment is not complete or fully functional.</p> <p>Year 3 – Inoperability of the ENC</p>

<p>electronic equipment to use them.</p>	<p>completed.</p> <p>Well-functioning ENC's for MEH demonstration section of the Straits available for use by appropriately-equipped ships.</p>	<p>system indicates technical problems and will delay project completion.</p>
<p><b>Component Three:</b> A significant number of large ships that regularly transit the Straits are equipped and their staff trained to use all components of the Marine Electronic Highway (MEH) system and their electronic communication systems are fully compatible with it.</p>	<p><b>Component Three:</b> At least 160 large oil tankers and container ships that regularly pass through the Straits are able and choose to navigate through the Straits using Electronic Navigation Charts and all other components of the demonstration MEH system.</p>	<p><b>Component Three:</b> Year 4 - The proportion of equipped ships using the MEH system and their assessment of its performance will guide refinement and promotion of it and color initial assessments of the feasibility of a potential Full-Scale MEH system.</p>
<p><b>Component Four:</b> Spatial and temporal factors that form and move sand waves in the Straits are analyzed, modeled and built into MEH system.</p> <p>Electronic Navigation Charts (ENCs) for the Straits show its environmentally-sensitive areas.</p> <p>Environment staff in the three littoral states can interpret marine environment threat information and respond effectively to marine environment emergencies.</p>	<p><b>Component Four:</b> Sand wave model for the Straits produced, tested and integrated into the MEH system.</p> <p>Environmentally sensitive areas within and near MEH demonstration area mapped and incorporated into MEH system's ENCs.</p> <p>Environment staff in the three littoral states successfully complete simulated marine environment emergency response exercises.</p>	<p><b>Component Four:</b> Year 3 – Practical tests of sand wave modeling system determine if it's working satisfactorily.</p> <p>Year 4 – Tests of the ENC system confirm environmentally sensitive area data has been incorporated.</p> <p>Year 4 – Monitoring of the exercises by senior national environment officials will indicate if the training for and organization of them was effective and/or needs further improvement.</p>
<p><b>Component Five:</b> Information on experience with developing the demonstration MEH is effectively disseminated to all regional and global stakeholders.</p> <p>Economic and financial viability, environment benefits, and legal feasibility of a Full-Scale MEH for entire Straits and an Environment Fund co-financed by it evaluated, based on MEH Demonstration Project's performance.</p> <p>Stakeholders decide whether to develop Full-Scale MEH system for the entire Straits and initiate planning.</p>	<p><b>Component Five:</b> Well-designed and functioning Web Page created for MEH; suite of informative publications issued.</p> <p>Workshop held on demonstration system design and performance.</p> <p>Evaluation of potential economic, financial and environmental costs/benefits and legal feasibility of MEH system, based on performance of the demonstration, approved by key stakeholders.</p> <p>If, based on evaluation, stakeholders decide to develop Full-Scale MEH system for the entire Straits, proposal for design, financing plan, and institutional arrangements prepared.</p>	<p><b>Component Five:</b> Stakeholder consultations indicate if dissemination program effective and how it could be improved.</p> <p>Stakeholder reactions to draft evaluation report indicate where and how it needs to be improved.</p> <p>Stakeholder consultations on evaluation indicate if they're likely to commit to Full-Scale MEH for the entire Straits and that this work should be done.</p>

### Arrangements for Results Monitoring

Outcome Indicators	Baseline	Target Values					Data Collection and Reporting		
		YR1	YR2	YR3	YR4	YR5	Frequency and Reports	Data Collection Instruments	Responsibility for Data Collection
<p>The littoral states and commercial shipping users of the Straits jointly decide whether or not to develop a MEH for the entire Straits and an Environment Fund, based on evaluation of the demonstration project and a cost/benefit and financial/legal feasibility analysis of a potential full MEH system for the entire Straits.</p> <p>If their decision is positive, a Full-Scale MEH for the entire Straits of Malacca and Singapore and an Environment Fund are designed and a financing and institutional plan for them prepared.</p>	<p>No decision on a MEH for entire Straits</p> <p>No Straits MEH system design/plan</p>					<p>100%</p> <p>100%</p>	<p>During year 5</p> <p>By end of year 5</p>	<p>Agreed minutes of stakeholder decision meeting on possible MEH system for the entire Straits.</p>	<p>IMO/The Bank</p> <p>IMO/PMO</p>
<b>Results Indicators for Each Component</b>									
<p><b>Component One:</b> PIPs prepared and implemented on schedule and updated annually, financial management system effective, disbursements on schedule.</p> <p>All partners report project management system is functioning effectively.</p> <p>Four MEH data centers established. Data production and management system functioning satisfactorily.</p> <p>MEH demonstration system for congested 300 kilometer section of the Straits fully functional.</p>	<p>No activity</p> <p>No activity</p> <p>No activity</p> <p>No activity</p>	<p>100%</p> <p>100%</p> <p>80%</p>	<p>100%</p> <p>100%</p> <p>100%</p>	<p>100%</p> <p>100%</p> <p>100%</p>	<p>100%</p> <p>100%</p> <p>100%</p> <p>75%</p>	<p>100%</p> <p>100%</p> <p>100%</p> <p>100%</p>	<p>Semi-annual</p> <p>Annual PSC meetings</p> <p>Semi-annual</p> <p>Semi-annual</p>	<p>Progress report</p> <p>Stakeholder consultations</p> <p>Progress report</p> <p>Progress report</p>	<p>IMO/PMO</p> <p>IMO/The Bank</p> <p>IMO/PMO</p> <p>IMO/PMO</p>
<p><b>Component Two:</b> Indonesian navigational data gathering system in Straits upgraded and data provided to MEH PMO.</p> <p>Hydrographic survey of MEH area completed.</p> <p>Well-functioning ENC's for MEH demonstration section of the Straits available for use by appropriately-equipped ships in transit.</p>	<p>No activity</p> <p>No activity</p> <p>No activity</p>	<p>40%</p> <p>20%</p>	<p>100%</p> <p>100%</p> <p>100%</p>	<p>100%</p> <p>100%</p> <p>25%</p>	<p>100%</p> <p>100%</p> <p>100%</p>	<p>100%</p> <p>100%</p> <p>100%</p>	<p>Semi-annual</p> <p>Semi-annual</p> <p>Semi-annual</p>	<p>Progress reports</p> <p>Progress report</p> <p>Progress report</p>	<p>Indonesian DG of Sea Transport, IMO/PMO</p> <p>IMO/PMO</p> <p>IMO/PMO</p>

<p><b>Component Three:</b> At least 160 large oil tankers and container ships that regularly pass through the Straits are able and choose to navigate through the Straits using Electronic Navigation Charts and all other components of the demonstration MEH system.</p>	Ships use Straits' Auto Identification System				80%	100%	Quarterly	Reports from ships using the MEH	Ship captains, IMO/PMO, INTERTANKO and ICS
<p><b>Component Four:</b> Sand wave model for the Straits produced, tested and integrated into the MEH system.</p>	No activity		25%	100%	100%	100%	Semi-annual	Progress report	IMO/PMO
<p>Environmentally sensitive areas within and near MEH demonstration area mapped and incorporated into MEH system's Electronic Navigation Charts.</p>	No activity		25%	100%	100%	100%	Semi-annual	Progress report	IMO/PMO
<p>Environment staff in the three littoral states successfully complete simulated marine environment emergency response exercises.</p>	No activity			25%	100%	100%	Semi-annual	Activity plans and completion reports	Env. agencies of Indonesia, Malaysia and Singapore
<p><b>Component Five:</b> Well-designed and functioning Web Page created for MEH; suite of informative publications issued.</p>	No activity		50%	75%	90%	100%	Semi-annual	Progress report	IMO/PMO
<p>Workshop on demonstration system design and initial performance held.</p>	No activity				50%	100%	On completion	Completion report	IMO/PMO
<p>Evaluation of potential economic, financial and environmental costs/benefits and legal feasibility of MEH system for entire Straits and Environment Fund co-financed by it, based on performance of the demonstration, approved by key stakeholders.</p>	No activity				20%	100%	On completion	Completion report	IMO/PMO
<p>If, based on evaluation, key stakeholders decide to develop Full-Scale MEH for the entire Straits, proposal for its design, financing plan and institutional arrangements prepared.</p>	No activity					100%	On completion	Completion report	IMO/PMO

**Annex 4: Detailed Project Description**  
**Marine Electronic Highway Demonstration Project**

The objectives of the US\$ 17 million Marine Electronic Highway Demonstration Project are:

- (a) to assist the Republic of Indonesia, Malaysia, the Republic of Singapore and representatives of some of the large commercial ship owners that use the Strait of Malacca and the Strait of Singapore, to collectively decide whether to establish a marine electronic highway for the entire length of the Straits of Malacca and Singapore; and
- (b) to improve maritime safety and reduce environmental damage to the globally-significant shared natural resources of the Straits of Malacca and Singapore.

The Project aims to establish whether or not a Full-Scale MEH system for the Straits of Malacca and Singapore is economically and environmentally justified and is financially sustainable through:

- (a) developing the MEH for the narrowest and most congested 300 kilometer section of the Straits and demonstrating its value for improving navigation safety and marine environmental protection,
- (b) facilitating the integration of marine environment systems and data flow and information exchange through the MEH system,
- (c) developing the operational and administrative mechanisms for the sustainable management of the MEH system,
- (d) evaluating the financial, economic and legal feasibility and the environmental benefits of a Full-Scale MEH system covering the entire Straits and
- (e) developing the technical design of and the proposed legal, institutional and financial arrangements for a Full-Scale MEH system covering the entire Straits, and analyzing the feasibility of an MEH-linked Marine Environment Fund to support local marine environmental conservation activities.

The total Project cost is US\$17 million, of which US\$8.3 million will be financed by the Global Environment Facility (GEF), US\$6.0 million by private sector participants (ship-owners), and US\$2.7 million by the three littoral states.

## **Project components**

The Project has five components and a number of sub-components as follows:

### **Component 1: MEH System Design, Coordination and Operation (US\$2.88 million)**

This component will provide for project management by the International Maritime Organization (IMO) on behalf of the participating countries, coordination of the design, development and operation of the MEH demonstration system and also provide for key technical inputs to the project. The main functions will be performed by the staff of a Project Management Office (PMO), which will operate under the responsibility of the IMO. The PMO will be located on the island of Batam, Indonesia, almost directly across the Straits from Singapore. It will be co-located with Indonesian Government's marine management bureau that is responsible for the Indonesian waters of the MEH demonstration section and will be housed in facilities provided and serviced by the Government of Indonesia.

The major tasks to be undertaken within this component will be:

1. System Planning and International Maritime Organization Management (US\$0.53 million)
  - (a) Management of the operational aspects of the Project by the International Maritime Organization.
  - (b) Development of a system for the management and on-line access and storage of data and information, including links to the MEH Data Centers and financial and economic assessments.
  - (c) Development of criteria and measurable indicators for Project performance assessment, including the carrying out of a baseline survey to compile and analyze data and information covering a period of about thirty years up to the inception of the Project, as a basis for evaluation of the impact of the MEH system.

This activity will develop long-term cost-effective and efficient system to handle the management of data/information for online access and storage. It will also link up with a number of activities dealing with the establishment of the MEH Data Centers and warehousing including financial and economic assessment.

The MEH Demonstration Project is envisaged to lead to a Full-Scale MEH that will involve the entire Malacca Straits. As such, it is necessary to evaluate the performance of this Project and as an initial step this activity will deal with the development of criteria and measurable indicators for project performance assessment taking into account the GEF, the Bank and IMO requirements.

A consultative meeting will be organized to validate the criteria and indicators for performance assessment of the MEH Demonstration Project

This activity will evaluate the impacts and contributions of the demonstration MEH system on maritime safety and marine environment protection in the Straits of Malacca and Singapore. Part of this task will be to carry out a baseline survey to compile and analyze data/information

covering a period of 30 years to the inception of the Project. The output of the baseline survey together with data gathered in the course of Project implementation will be the basis for evaluation of the impacts and contribution of the MEH system.

2. Project Management Office (US\$1.71 million)

(a) Strengthening the capacity of the staff of the Project Management Office, including relevant training.

(b) Establishment of MEH Data Centers in the Republic of Indonesia, Malaysia and the Republic of Singapore, including provision of relevant training to the staff of the MEH Data Centers in operation and management of the MEH system and in data handling and exchange.

To ensure that the MEH system is effective and efficient, competent staff must handle its operation and maintenance. This sub-component will comprise capacity building for the MEH system for the purpose of developing the skills and aptitude of personnel to operate and maintain the MEH system including technical backstopping at the regional level. National staff assigned to the Project's data centers will undergo training with a regional focus so that they will be able to appreciate and understand the objectives, components, and implementation arrangements for the Project.

This activity will support the establishment and commissioning of three MEH Data Centers in Indonesia, Malaysia and Singapore including the selection of staff, organizational and management structure. The efficient and effective operation and management of the MEH Data Centers will depend on well-trained staff. This activity will support several short-term hands on training for the staff of the MEH Data Centers covering operation and management, data handling and exchange.

3. Project Steering Committee Support (US\$0.64 million). Carrying out of meetings of the Project Steering Committee, the Technical Committees and the Working Groups, including travel and accommodations for participants.

A Project Steering Committee (PSC) was established during the Project preparation period and this will continue to be the directing force behind the project during the Demonstration phase. Members of the PSC are the agencies that were denominated as the counterparts representing the three participating states. The PSC is and will continue to be advised by the IMO and the two shipping agencies that have committed ships to participate in the Demonstration phase will have observer status. The Technical Committees (TCs) and Working Groups (WGs) already established by the PSC will continue into the Demonstration phase (see Annex 6).

This sub-component will finance the travel and accommodation costs of the three littoral states in attending meetings of the PSC and its TCs and WGs, which will be held in rotation among the countries unless they agree otherwise as committee members. In general the meetings of the PSC and its TCs and WGs will be concurrent. The costs of hire of facilities for the holding of meetings will also be met from this sub-component.

Incremental Operating Costs (US\$0.67 million) are included in the above component and covers costs which would not have been incurred without the Project and includes travel and per diem

by staff of the PMO, PSC, WGs and TCs, communications, consumables, advertising of bidding, printing and publication of Project information, rental of meeting facilities, but excludes staff salaries.

## **Component 2: MEH System Development (US\$7.04 million)**

This component will provide for production of the navigational information on which the MEH system will be based, and its incorporation into real-time electronic charts that ship operators will be able to use to navigate with precision through the MEH demonstration section of the Straits. These activities will be coordinated by the PMO, under the direction of the IMO, and comprise the following sub components:

1. Tide and Current Facilities (US\$2.63 million). Tidal and current monitoring on the Republic of Indonesia's coast of the Strait of Malacca, including provision of relevant equipment.

Navigational safety facilities in the Indonesian coast of the Malacca Strait are very limited compared to Malaysia and Singapore. Under this sub-component, Indonesia will procure certain equipment such as Differential Global Positioning Systems (DGPS), Automatic Identification Systems (AIS) and oceanographic equipment for tidal and current monitoring. Testing and commissioning of the equipment is included.

2. Hydrographic Survey (US\$3.21 million). (a) Carrying out of a hydrographic survey within the designated traffic separation scheme in the Strait of Malacca within the Project Area and (b) Provision of training to the hydrographic surveyors of the hydro-oceanographic services of the Republic of Indonesia, Malaysia and the Republic of Singapore.

This activity will comprise a bathymetry survey of the sea lanes of the Traffic Separation Scheme within the project area of the Malacca Strait using multi-beam echo sounder and DGPS to provide complete bottom coverage. The output of the multi-beam survey will be stored as a high precision database that will be used to produce high quality Electronic Navigation Charts (ENCs). This task will include refinement of the hydrographic survey work plan by the Technical Committee on Hydrographic Survey and ENC production to ensure that the survey adequately addresses the requirements of the project apart from the production of ENCs. The hydrographic survey will be contracted out through an international competitive bidding process, which will be conducted by the IMO in consultation with the PSC. The Hydrographic Offices of the three littoral States will carry out a joint supervision of the hydrographic survey. A capacity building component is included, mainly to provide training for the hydrographic surveyors of the three littoral States, in particular for the Hydro-Oceanographic Service of the Indonesia Navy (DISHIDROS) and the Hydrographic Department of the Royal Malaysian Navy.

3. Electronic Navigation Charts (US\$0.34 million). Production of high resolution electronic navigation charts for the Project Area, including provision of relevant computer software licenses to the Republic of Indonesia and to Malaysia.

Present ENC's in the Strait of Malacca from Jambo Ayer in the northern entrance to Karimun are based on hard-copy paper charts with the scales of 1:300,000 and 1:200,000. In order to assess the value added of high density ENC's (e.g., 1:10,000 scale) for through maritime traffic and port approaches, a comparative assessment of the ENC's prepared using multi-beam technology with DGPS and the current ENC's prepared under the Joint Four Nation Survey will be carried out. Technical, economic, financial and market analyses will be conducted for comparative evaluation as well as risk assessment with respect to groundings and collision avoidance including maneuvering over a small area around the port. Specifically, this sub-component will cover the following activities:

Procurement of the production software will be carried out by IMO through a competitive bidding process with technical inputs from International Hydrographic Organization and the Technical Committee for Hydrographic Survey and ENC production. Six licenses of ENC production software will be procured through an international competitive bidding procedure. There is a training component in the software package. Hydrographic data from the survey will be processed through this software for the production of high resolution ENC's.

The ENC's will be produced by specialist cartographers of the Hydrographic Offices of Indonesia and Malaysia. Production will cover evaluation of survey data format and compilation into S-57 data sets for Sector 1 to 6 of the Malacca Strait. Field verification and sea trials will be carried out on the official ENC's produced as part of the final assessment before release for ship use. Product packaging includes data encryption, marketing and distribution including evaluation and formalization of data update mechanism. Official ENC's of Sectors 1 to 6 of the Malacca Strait will be joined with the existing ENC's of Singapore waters providing streamlined ENC's of the whole Project Area.

4. Information Exchange System (US\$0.86 million). Establishment of a MEH information exchange system, including data servers, data exchange protocols and training of staff in data exchange.

The core of the Marine Electronic Highway will be the exchange of data between various systems that would otherwise be independent of each other. The Information Exchange System will provide the hardware (data servers), software (data exchange protocols) and human resources (training of staff) to permit these exchanges to take place. At the end of the MEH Demonstration Project an assessment of the efficiency with which the data exchanges are able to take place will be a critical component of its evaluation.

### **Component 3: Ship-board Equipment and Communications (US\$6.00 million)**

Carrying out of testing of the demonstration MEH system by about 160 ships fitted with type-approved electronic chart display and information systems, including internet connectivity. This component will be executed by the owners of at least 160 large oil tankers and container ships that regularly transit the Straits, and will be facilitated by two major ship owner representative organizations, the International Association of Independent Tanker Owners (INTERTANKO) and the International Chamber of Shipping (ICS). With the facilitation of INTERTANKO and ICS, the ship owners will arrange that, by the end of year three, at least 160 of their ships that regularly transit the Straits are fitted with internationally-approved ECDIS and Automatic

Identification System (AIS) and have internet connectivity—these elements comprise the suite of technical equipment required to use all the elements of the MEH demonstration system. In addition, the ship owners will ensure that, once the MEH demonstration system is operational, all of the 160 ships which are so equipped always use it when transiting the Straits and provide detailed and timely feed-back on its performance to the Project Management Office and later to the independent experts tasked with evaluating the demonstration system and assessing the costs, benefits and legal/financial feasibility of expanding it to cover the entire Straits (see component 5). A minimum of 160 ships fitted with type-approved ECDIS and AIS, including internet connectivity, have been committed by INTERTANKO and ICS to participate in the project. These ships will participate to test-run the demonstration MEH system. The ECDIS will allow the ships to use the official ENC's and together with AIS and Internet connectivity will enable the flow of relevant information from the MEH Data Centers to the ships and vice versa.

#### **Component 4: Marine Environment Protection (US\$0.85 million)**

This component will be executed jointly by the institutions in the littoral states that are responsible for marine navigation and environmental management and the International Maritime Organization and will consist of the following activities:

1. Oil Spill and Sand Wave Models (US\$0.49 million). Carrying out of a modeling and analyses of: (i) the likely movement of oil spills originating in the Project Area, and (ii) the sand wave formation and movement in the Project Area.

Sand waves in the Malacca Straits are well known phenomena but little understood. This sub - component will include determination of the spatial and temporal factors that affect the behavior of sand waves. Assessment of the factors through model development will be carried out for the purpose of forecasting the phenomena with field-testing.

2. Sensitive Area Mapping (US\$0.33 million). Research and development of options for providing real-time geo-referenced environmental protection information to mariners navigating in the Straits of Malacca and Singapore and for conservation and coastal resources management and mapping of sensitive areas.

This activity will include research and development of options for providing real-time geo-referenced environmental protection information to mariners navigating in the Straits of Malacca and Singapore and will also be available for conservation and coastal resources management including sensitivity mapping. This supplemental navigation-related information to electronic navigation charts will be developed in accordance with International Hydrographic Organization, IMO and International Electrotechnical Commission standards.

3. Emergency Response Systems (US\$0.03 million). Carrying out of simulated oil and chemical spill emergency response exercises to determine the cost-effectiveness and efficiency of the MEH system in the event of chemical and oil spill incidents from ships.

This sub-component will provide simulated oil and chemical spill emergency response exercises to determine the cost-effectiveness and efficiency of the MEH system in the event of chemical and oil spill incidents from ships. Factors that will influence the success of chemical and oil spill

response and control will be critically evaluated in order to enhance the utility of the MEH system in emergency response and control.

The Demonstration MEH system is envisaged as a multi-user system capable of providing products and services not only to the shipping sector but also to those involved in marine and coastal management in the Straits, in particular, on the prevention and response to chemical and oil spills including deliberate discharges. Chemical and oil spill response and control are emergency situations and as such, appropriate guidelines and protocols need to be developed within the framework of the MEH system to avoid any disruption or system overload.

### **Component 5: Information Dissemination, Evaluation and Scale-Up Plan (US\$0.23 million)**

This component will be managed by the International Maritime Organization (IMO) through the Project Management Office (PMO), and will produce the following outputs:

1. Website and Publicity (US\$0.091 million). Production and dissemination of information through the Internet on the MEH system, including technical reports, progress reports and a newsletter, and carrying out of national and regional workshops and seminars to provide information and seek feedback on the benefits and applicability of the MEH system.

This sub-component will provide for the production and dissemination of information on the MEH system (such as technical reports, progress reports and a newsletter) via the Internet. In addition, national and regional workshops and seminars will be held, giving information and seeking feedback on the benefits and applicability of the MEH system.

2. Evaluation (US\$0.06 million). (a) Assessment of the cost and benefits of the establishment and use of the MEH system in terms of maritime safety and marine environment protection, including (i) the development of criteria and measurable indicators for the socio-economic assessment of the MEH system, and (ii) the carrying out of a socio-economic survey to evaluate the benefits of the MEH system; (b) (i) Carrying out of an assessment of the technical functionalities of the MEH system, including system performance, (ii) Carrying out of a continuous monitoring of new and potential technologies that could be linked to the MEH system or enhance its performance, including the carrying out of technical evaluations on the new technologies to determine their suitability, value added contribution, enhancing performance and cost effectiveness, (c) Carrying out of an assessment of the MEH system, including institutional and legal aspects, and (d) Consolidation of the technical, institutional, legal, financial and economic assessments of the MEH system, including the implementation of the Project, and development of a managing tool blueprint.

#### *Economic and Social Evaluation.*

The implementation of the MEH system is expected to have significant societal and economic impacts, particularly among the three littoral states. This sub-component will assess the cost as

well as the benefits that accrued from the establishment and use of the MEH system in terms of maritime safety and marine environment protection. It will also evaluate the effects and impacts of the MEH functionalities against pre-MEH period on the coastal communities, the maritime sector, and the public sector as well as those engaged in cross-channel trade. Specifically, this sub-component will cover the following activities:

**Development of criteria and measurable indicators for the socio-economic assessment of the MEH system:** This activity involves the preparatory phase for a socio-economic survey and covers the development of criteria and measurable indicators for the socio-economic evaluation of the MEH system. An appropriate survey questionnaire will be developed and statistical analysis will be established.

**Socio-economic survey to evaluate the benefits of the MEH system:** This activity deals with the conduct of a socio-economic survey for potential and target users of the MEH system and the subsequently analysis of the survey results.

#### *Operational feasibility*

**Assessment of the technical functionalities of the Demonstration MEH system:** This activity will cover system performance assessment of the Demonstration MEH system. The assessment will be based on agreed measurable indicators to be established by the Technical Committees on shore- and ship-based facilities such as interoperability, cost effectiveness, reliability, user friendliness, access, authentication of sources of information, flexibility, effective response to emerging needs, reduction in data collection burden and efficient use of resources, among others. These indicators will be defined based on standards, performance criteria or existing practices.

**Survey of new potential technologies for the MEH system:** This sub component will fund continuous monitoring of new and potential technologies in the market that could be linked to the MEH system or to enhance its performance and enable it to meet the increasing needs of the shipping industry as well as users from the other sectors. Applicable performance criteria, standards and guidelines will be adopted in the integration of new technologies into the MEH system. Technical evaluation will also be conducted on the new technologies to determine their suitability, value added contribution, enhancing performance and cost effectiveness, among others.

#### *Financial feasibility and financing plan*

This sub-component will provide an assessment of the financial viability of the MEH system (use, access, flow of information, real time communication and provision of services, etc.), which will cover the infrastructure, operation and management of the system as well as to conduct market analysis for potential users (e.g., willingness to pay). It will also include a review of potential revenue generation of additional value-added services. On the environmental aspects, the financial feasibility will include an assessment of the revenues and costs of integration of environmental systems.

A user survey will be undertaken to assess the acceptability of the proposed Full-Scale MEH. The population of potential users to be surveyed will include all actual and expected future maritime users of the Straits, including cross Straits users such as ferry operators.

There are many ways in which users could be charged for the services to be provided under the Full-Scale MEH. A review of the methods will be undertaken within this sub-component to assess their technical and operational feasibility and a recommendation will be presented to the Project Steering Committee (PSC) for a decision on which method to adopt. It is the method chosen by the PSC that will be included in the description of the Project included in the user survey.

Once the user survey has been completed and before the PSC makes its final decision on whether to proceed with the Full-Scale MEH, and if so how it will function, a consultative meeting with potential users will be held to present the characteristics of the system to them and obtain their reaction and receive any alternative proposals.

#### *Institutional analysis and plan.*

This activity will consolidate the output of several activities covering, technical, institutional, legal, political, financial and economic assessment of the MEH system including the implementation of the Project. The consolidated output will be the basis for the development of a managing tool blueprint. The preliminary draft of a managing tool blueprint will be submitted for a critical evaluation by a group of experts and to be followed by further refinement of such a blueprint.

3. System Development (US\$0.077 million). Carrying out of marketing strategies to package and market the MEH system and its marine information and other products, and the services it could provide.

This sub-component focuses on marketing strategies to package and market the MEH system and the essential marine information it carries, other products and the services it could provide, in order to draw in potential users and partners, especially those who are dealing with coastal management, marine environment management, certain non-governmental organizations, and user States including relevant entities outside the three littoral States.

**Annex 5: Project Costs**  
**Marine Electronic Highway Demonstration Project**

<b>Project Cost By Component and/or Activity</b>	<b>Local (US\$ million)</b>	<b>Foreign (US\$ million)</b>	<b>Total (US\$ million)</b>
1. MEH System Design, Coordination and Operation <sup>1</sup>	0.84	1.80	2.64
2. MEH System Development	0.68	5.76	6.44
3. Shipboard Equipment and Communications	0.63	5.37	6.00
4. Marine Environment Protection	0.18	0.59	0.77
5. Dissemination, Evaluation and Scale-up Plan	0.05	0.17	0.22
Total Baseline Cost	2.38	13.69	16.07
Price and Physical Contingencies	0.22	0.71	0.93
<b>Total Project Costs<sup>2</sup></b>	2.60	14.40	17.00

<sup>1</sup>International Maritime Organization management and technical supervision cost (US\$0.5 million) and incremental operating costs (US\$0.67 million) are included in Component 1.

<sup>2</sup>There are no identifiable taxes or duties and the total project cost, net of taxes, is US\$17.00 million and the share of project cost net of taxes is 100 percent.

Base costs are estimated in December 2005 prices.

### Detailed Project Cost by Sub-Component

Component	Indicative Total Cost (US\$)	% of Total Cost	GEF Financing (US\$)	% GEF
1. System Design, Coordination and Operation				
A. System Planning and IMO Management	500,000		500,000	
B. Project Management Office	1,550,000		1,110,000	
C. PSC Support	590,000		375,000	
Sub total	2,640,000	15.5%	1,985,000	75.2%
2. System Development				
A. Tide and current facilities	2,400,000		1,310,000	
B. Hydrographic survey	2,920,000		2,810,000	
C. Electronic Navigation Charts	300,000		170,000	
D. Information Exchange Systems	830,000		350,000	
Sub total	6,450,000	37.9%	4,640,000	71.9%
3. Ship board equipment	6,000,000	35.3%	0	0.0%
4. Marine Environment Protection				
A. Oil spill and wave models	440,000		440,000	
B. Sensitive area mapping	300,000		300,000	
C. Emergency Response system	30,000		30,000	
Sub total	770,000	4.5%	770,000	100.0%
5. Dissemination, Evaluation and Scaling up				
A. Web site and Publicity	80,000		80,000	
B. Evaluation	60,000		60,000	
C. System Development	70,000		70,000	
Sub total	210,000	1.3%	210,000	100.0%
Total without contingencies	16,070,000	94.5%	7,605,000	47.3%
Contingencies	930,000	5.5%	695,000	74.7%
<b>Total</b>	<b>17,000,000</b>	<b>100.0 %</b>	<b>8,300,000</b>	<b>48.8%</b>

*Base costs are estimated in December 2005 prices*

Equipment costs are based on prevailing market prices quoted by manufacturers and suppliers. The costs of consulting services are based on those of recent contracts for similar services carried out for International Maritime (IMO). The cost of the hydrographic survey is based on the rental cost of survey ships and their operating cost, and reflects the current supply-demand situation for the region.

Financing of the project will come from the participating governments, ship operators and the Global Environment Facility (GEF). The governments will between them finance about 16 percent of the cost, the ship operators over 35 percent (for the on-ship equipment and crew training), and the GEF slightly less than 49 percent. The GEF grant will be in two parts, one to the government of Indonesia (US\$1.44 million) to fund the purchase of essential equipment (marine buoys) that Malaysia and Singapore already have or will finance from their own resources and one grant to the IMO (US\$6.86 million), to contract the hydrographic survey, the

various technical studies, and for the professional staff of the Project Management Office (PMO). Indonesia has agreed to fund the secretarial staff of the PMO. It is probable that the contribution from the ship operators will exceed the US\$6.0 million indicated. This amount is based on the participation of 120 ships and an investment of US\$50,000 per ship, but the current commitment is already for 160 ships. The number of participating ships is expected to be significantly greater, the 160 being the number of commitments to participation at the time of project preparation.

### **Project Costs by Funding Source**

<b>Source</b>	<b>US\$ million</b>	<b>% of total</b>
Indonesia	1.50	8.8
Malaysia	0.90	5.3
Singapore	0.30	1.8
Ship operators	6.00	35.3
GEF	8.30	48.8
<b>Total</b>	<b>17.00</b>	<b>100.0</b>

*Source: World Bank estimates*

Since this is a demonstration project and it will cover a period of four years, the cost estimates are even less certain than usual. In particular, the costs of the hydrographic survey could be different than estimated. The cost could be much higher because of the uncertain effect of the need to avoid interference with commercial shipping on the rate of surveying that can be maintained, but then it could be lower because of a short term excess supply of surveying vessels.

There is also the possibility that a newly developed satellite based surveying method could dramatically reduce the overall costs. Since the surveys would be carried out continuously in real time, there would be no need for periodic resurveying and no need to develop and use the sand wave and tidal models. The new surveying technique could give the actual depth of water available as frequently as the satellite passes over the Straits, perhaps once every few hours. This technology is now in advanced state of development and is expected to be available in the early stages of this MEH Demonstration Project.

Given the current widespread interest in the project by governments of the states most likely to benefit from the project and the prospect of a new technology that could dramatically enhance the quality of the project, a mid-term review is more necessary than usual for the project. The governments of some of the states that are potential beneficiaries of the MEH have recently expressed an interest in participating in the design and implementation of the demonstration project and in funding some of its activities. Responsibility for deciding whether such offers should be accepted, and if so, under what conditions, rests with the Project Steering Committee, but there has not yet been an opportunity to consider the offers.

## **Annex 6: Implementation Arrangements**

### **Marine Electronic Highway Demonstration Project**

#### **General Approach to Implementation**

The International Maritime Organization (IMO) is responsible for the management of the Project and will initiate the startup activities covering procurement, recruitment of a project consultant and the establishment of the Project Management Office (PMO). The startup period will initiate the procurement and installation of Indonesia's project facilities as well as the hydrographic survey under Component 2.B of the Project. The implementation schedules of the individual Project components are shown in the Project Implementation Plan.

An implementation consultant will be hired during the startup period to launch the Project and lay the ground work for the recruitment of a Project Manager. IMO will supervise and monitor the work of the project consultant in close consultation with the World Bank, littoral States and partners. IMO will also work with Indonesia (Ministry of Environment and the local authorities) to establish the PMO in Batam through a *Memorandum of Agreement*.

IMO will delegate some level of authority to the Project Manager for a more direct, cost-effective and efficient onsite administration and management of the Project. A standing management procedure for the PMO in the implementation of the project covering procurement, financial and administrative arrangements including backstopping from the IMO Headquarters will be formulated and will be put into effect following the appointment of the Project Manager.

#### **Project Steering Committee**

The Project Steering Committee (PSC) established during the project preparation (PDF Block B Grant period) will be re-established to act as the overall regional body to oversee the implementation of project activities in both the demonstration and the full-scale stages of the MEH. The PSC will provide the institutional arrangement for the development of the managing tool, which will operate, administer and manage the MEH system on a sustainable basis under a cooperative agreement among relevant stakeholders of the Malacca Straits. The PSC is composed of the following lead agencies and organizations:

##### Permanent Members:

- Indonesia - Ministry of Environment
- Malaysia - Marine Department, Peninsular Malaysia
- Singapore - Maritime and Port Authority

##### Secretariat

- International Maritime Organization

##### Observers with Advisory and Consultative Status

- International Hydrographic Organization
- International Association of Independent Tanker Owners
- International Chamber of Shipping.

The terms of reference and the organizational structure of the PSC (as revised and approved by the third PSC Meeting during Project preparation (PDF Block B period)) including the Rules of Procedure and terms of reference of Observers were approved by the first PSC Meeting, Putrajaya, Malaysia in March 2001 (in Annex A of the *Memorandum of Understanding*). The *Memorandum of Understanding* and the *Memorandum on Arrangements* further strengthen the cooperation and collaboration among all parties to implement the Project.

### **International Maritime Organization**

The International Maritime Organization (IMO) has for many years been associated with the development of maritime safety and marine environment protection mechanisms that have direct impacts on the Straits of Malacca and Singapore and developing close working relationship with the three littoral States at both national and regional levels. The IMO is cognizant of the regional and national sensitivities involved in the development, promulgation and implementation of maritime safety and marine environment mechanisms in the East Asian Seas region, in particular, the Straits, and has served as the focal point for regional and international consultation and the development of appropriate instruments, which are already in place in the region.

IMO serves as the Secretariat of the PSC but in the course of implementing the MEH Demonstration Project, the Project Management Office will carry out some of the secretariat functions of IMO in the conduct of PSC meetings. IMO will sign a Grant Agreement with the World Bank which outlines the agreed implementation arrangements for the project and the financial management and procurement procedures. The IMO has the overall responsibility in the management of the project and will implement its various activities as contained in the Project Implementation Plan through the Project Management Office and will provide the necessary administrative, management and technical support and inputs to the Project, technical guidance to the PSC and undertake regular project review, monitoring and evaluation including audit to improve project performance and delivery. It will also submit quarterly progress reports for the Project.

### **Republic of Indonesia, Malaysia and Republic of Singapore**

The littoral States of Indonesia, Malaysia and Singapore are the major players and beneficiaries of this project. Aside from their membership in the Project Steering Committee, Technical Committees and Working Groups, the littoral States will co-finance the implementation of this Marine Electronic Highway (MEH) Demonstration Project by providing in-kind contributions such as the use or access of maritime safety facilities, office space, equipment, utilities and deployment of local experts. Only Indonesia will sign a special agreement with the Bank regarding the procurement of maritime facilities to be installed in the Malacca Strait coast of Sumatra, which will be utilized by the project. The littoral States together with their designated National Focal Points, alternate Focal Points and lead/implementing agencies will work with the project team in partnership with relevant stakeholders to implement the activities of the five components of the MEH Demonstration Project including the development of the MEH Fund and the governing body of the MEH system (institutional arrangement). The littoral States will also work towards overcoming policy, institutional and legal barriers to the establishment of the MEH system in the Straits of the Malacca and Singapore.

## **Republic of Indonesia**

There are two Global Environment Facility grants to support the MEH Demonstration Project. The International Maritime Organization is the Recipient of a US\$6.86 million Grant and will be responsible for the management of the project and all components except the sub-component on tide and current facilities. The second Grant is to the Republic of Indonesia for US\$1.44 million. The Office of the Deputy Minister for Nature Conservation Enhancement and Environmental Destruction Control of the Ministry of Environment is the coordinating Ministry for the Indonesian part of the Project. The Directorate General of Sea Transport of the Ministry of Transport is the implementing agency (and will undertake all the procurement required for the Indonesian part of the Project). The Hydro-Oceanographic Service of the Navy of the Recipient will be responsible for the maintenance and operation of the tidal stations and the Directorate General of Sea Transport will be responsible for the maintenance and operation of the remaining equipment procured under the Project. The Hydro-Oceanographic Service will represent the Republic of Indonesia in the hydrographic surveys and the production of Electronic Navigation Charts to be carried out by the International Maritime Organization. Specifically Indonesia will execute the sub-component on tide and current facilities of Component 2 of the Project.

## **International Hydrographic Organization**

As a partner, International Hydrographic Organization will also be an observer member of the Project Steering Committee and will take part in the review and evaluation of the Project and the implementation of its activities including membership in various technical committees and working groups of the Project. Its major inputs to the Project will be to provide technical assistance in the development and production of Electronic Navigation Charts (ENCs), the development of ENC-based ecological or sensitivity maps and mapping services as well as leveraging technical cooperation (e.g., training, expert advice, use of facilities/equipment) from among its member States for the development of the Straits ENCs and related products.

## **International Association of Independent Tanker Owners and International Chamber of Shipping**

A keystone activity of the project is the demonstration exercise to evaluate the demonstration MEH system involving ship to ship and ship to shore interactions (i.e., communication, information/ data flow). The partnership with the International Association of Independent Tanker Owners (INTERTANKO) and the International Chamber of Shipping (ICS) will ensure that adequate commercial vessels will be made available for the technical evaluation of the MEH system (currently, about 160 ships from the two organizations have been committed to the project). Both INTERTANKO and ICS will identify ships that will be participating in the project (i.e., ships that regularly ply the Straits) including assessment of onboard availability of ECDIS and AIS as well as the use of digital technology, especially for Internet access. INTERTANKO and ICS will also assist in monitoring participating ships to ensure that they adhere to the requirements of the Project and also, to identify any constraints or problems that may arise onboard the ships during its participation in coordination with the Project Management Office. As partners, INTERTANKO and ICS will be observer members of the Project Steering Committee with advisory and consultative status. Both organizations will take part in the review

and evaluation of the Project and the implementation of its activities as a member of the various technical committees and working groups of the Project.

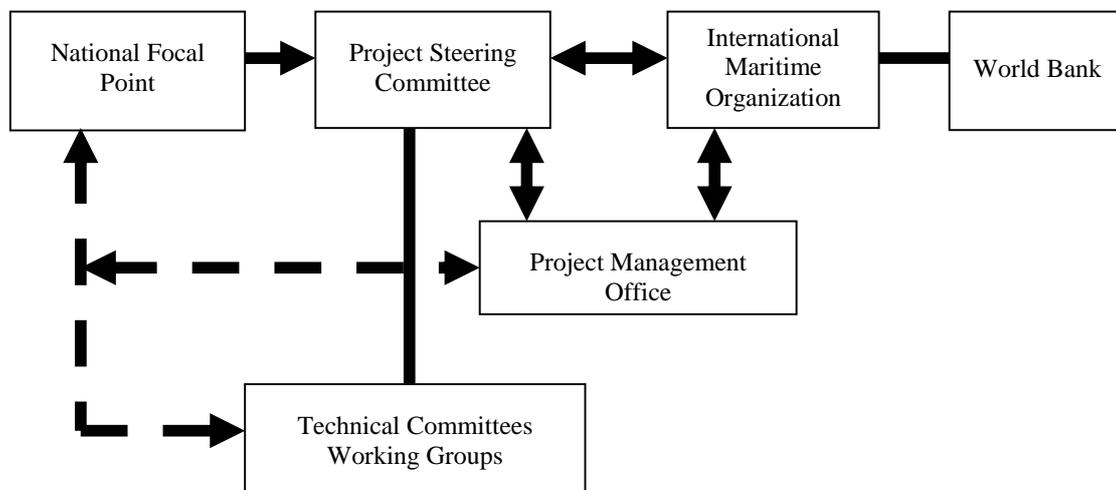
### Potential Partners

Potential partners of the Project (subject to the approval of the Project Steering Committee (PSC)) would include private sector partners such as technology providers like those engaged in digital technology and telecommunications and in the environment sector. Again subject to PSC approval, national governments of potential beneficiary countries (user states) might also participate in the Project as observers with advisory and consultative status. These potential partners could be involved in the development of various products and services of the MEH system, including but not limited to online and real time communications and data exchanges, packaging and marketing. The status of any actual additional partners would be decided by the PSC.

### Technical Committees and Working Groups

Four Technical Committees (TCs) and two Working Groups (WGs) will be established by the Project Steering Committee (PSC) in the course of implementing the MEH Demonstration Project to evaluate various technical issues and outputs of the project for the purpose of refining project activities as well as activities slated for the Full-Scale MEH. The TCs and WCs will be composed of relevant stakeholders of the MEH Demonstration Project and experts hired under the Project including potential users under the direction of the PSC. The PSC will be developed into the governing body or managing tool (i.e., corporate body) of the MEH system. This corporate body will operate, administer, maintain and manage the MEH system within the public private partnership framework. It is envisaged that the corporate body will be fully commissioned at the latter part of the second stage of the MEH. The overall organizational structure of the PSC, TCs and WGs is shown below:

**MEH Demonstration Project  
Organizational Structure**



The membership, frequency of meetings and responsibilities of the PSC, TCs and WCs are:

### Project Steering Committee meetings

Technical Committee/ Working Group	Meeting	Membership	Responsibilities
Project Steering Committee	Annual	National Focal Points International Maritime Organization (IMO), Partners	Overall policy directions/ strategies and guidance
TC on Survey and Electronic Navigation Charts (ENCs)	Standing	Hydrographic Department of Littoral States, Project Management Office (PMO), Partners	Planning, implementation, monitoring, evaluation Survey and ENC
TC on Shore Base Infrastructure and Facilities	Standing	Sea Transport (Indonesia), Marine Department (Malaysia), MPA (Singapore), IMO, PMO, KSTAS, DSMM, MMS, Dept of Meteorology, BAKOSUTANAL, Partners	Planning, implementation, monitoring, evaluation DGPS/AIS/Tide/Current Wind stations/Data Centers
TC on Ship Borne Equipment	Standing	Sea Transport (Indonesia), Marine Department (Malaysia), MPA (Singapore), IMO, PMO	ECDIS/AIS equipment Standards/compatibility Practical sea trials
TC on Environmental System and Information	Standing	BAPEDAL (Indonesia), DOE (Malaysia), DOE (Singapore), IMO, PMO	Modeling, system integration, environmental applications
WG on Cost Sharing for the Full-Scale MEH	<i>Ad hoc</i>	Same as Project Steering Committee	Sustainable financing mechanism, managing tool
WG on MEH Demonstration Project Evaluation	<i>Ad hoc</i>	Same as Project Steering Committee	Monitoring and evaluation, full-scale project proposal

### Project Management Office

A Project Management Office (PMO) will be established to administer and manage the Project on site. The office will be sited in Batam in Sumatra, Indonesia, close to Singapore<sup>1</sup> and will be hosted by the Republic of Indonesia. The PMO has a pivotal role in the implementation of this MEH Demonstration Project. It will carry out on site day to day operation, administration and management of the Project. It will also assist the IMO in secretariat activities, in particular, for the PSC, TCs and WGs and will come under the direct supervision of the Director of Marine Environment Division, IMO. The PMO will have the following functions:

<sup>1</sup> As agreed to at the Third PSC Meeting in Jakarta (October 13-15, 2003), the Meeting requested IMO to carry out site assessment of Port Klang, Malaysia and Batam, Indonesia as potential PMO and to report back to the PSC at its next session. At the Fourth PSC Meeting held in Singapore from December 15-16, 2003, the Meeting, at its Intergovernmental Session, agreed that the PMO site is Batam, Indonesia.

- To manage the Project in accordance with the objectives and the planned activities set out in this Project Appraisal Document and in the Project Implementation Plan with the guidance of the PSC;
- To develop a detailed work plan for the implementation of Project activities including milestones, schedules, monitoring strategies and evaluation/assessment criteria (e.g., updating the Project Implementation Plan);
- To handle the day-to-day administrative, financial and operation requirements of the Project;
- To organize, prepare and review relevant documents for the PSC and the TCs and WGs including Project progress and technical reports;
- To provide assistance in the establishment of the MEH National Data Centers including technical backstopping and monitoring of activities of such Centers;
- To organize Project workshops, training courses, meetings and related activities;
- To develop a database of local and international experts and specialists for participating in Project activities and in the recruitment of project consultants; and
- To promote the activities of the Project, in particular, its products and services as well as to strengthen partnerships with relevant stakeholders.

The PMO will have a Project Manager, one Administrative Assistant, four experts and support staff that will be hired by the Project. The terms of reference and qualifications of the Project Manager are available in the PIP. Senior staff of the PMO will be recruited through an international competitive process, in line with the Bank's Guidelines, whilst employment will be covered under IMO staff rules (series 100 and 200). The selection process for Project staff will involve the littoral States and IMO. The Secretary-General of the IMO will appoint the senior Project staff, including four experts/consultants to be recruited through an international competitive bidding to assist the PMO in the implementation of project activities. Local support staff will be nationally recruited through a competitive selection process. Since hiring a Project Manager will require a long time, to facilitate an early start to implementation activities for the first year of the project, the IMO is expected to contract an interim Project Launching Consultant until the full time Project Manger can start his/her duties.

### **Mid-Term Review**

It is planned to have a mid term review of the Project to review progress, and main problems and ways to handle them, implementation till completion of the Project, assess commitment of the partners to the Project as well as interest of countries to be involved in the Full-Scale MEH, evaluate new technologies and their potential applicability and inclusion in MEH, as well as to determine the need for Project restructuring, if any. This review is expected to involve IMO, the World Bank, Indonesia's Ministry of Environment, the Project Steering Committee, as well as representatives of all signatories to the *Memorandum on Arrangements*.

## **Annex 7: Financial Management and Disbursement Arrangements**

### **Marine Electronic Highway Demonstration Project**

#### **A. Assessment of the agencies' capacities to undertake Financial Management**

From a financial management perspective, the Marine Electronic Highway (MEH) Demonstration Project is considered a low risk project.

International Maritime Organization (IMO). The financial management arrangements for the Marine Electronic Highway (MEH) Demonstration Project activities implemented by the IMO are acceptable. As a specialized agency of the United Nations, the IMO follows acceptable accounting and reporting practices in accordance with the United Nations System Accounting Standards. IMO received an unqualified opinion on its most recent financial statements.

Republic of Indonesia. The Office of the Deputy Minister for Nature Conservation Enhancement and Environmental Destruction Control of the Ministry of Environment is the coordinating Ministry for the Project. The Directorate General of Sea Transport (DGST) of the Ministry of Transport (MOT) is the implementing agency and will undertake all the procurement required for Republic of Indonesia part of the Project, namely four goods packages. The funds under the Grant will all be for these four goods packages only. The financial management arrangements for the operations of MOT are acceptable subject to completion of the agreed action plan. The assessment of MOT concluded that (i) a Project Implementation Unit will have to be established by MOT with Navigation Director, DGST, as the head of the Satker, (ii) a Financial Officer recruited and assigned to administer the project activities and (iii) a letter regarding the audit arrangement should be submitted to BPKP. As Conditions of Effectiveness of the Grant, the Project Implementation Unit shall have been established and the Republic of Indonesia shall have established auditing arrangements, acceptable to the Bank, including provisions to make the audit report available to the public.

#### **B. Strengths and Weaknesses**

International Maritime Organization. IMO is a reputable United Nations agency with extensive experience in implementing donor-financed projects. The nature of the Project procurement (i.e., relatively few contracts, each being large in size) and resulting simplified accounting and reporting also contribute to the low risk rating. Since about 15-20 percent of the grants will be used for the procurement of equipment, physical inspection to confirm the proper use of Project funds will be possible.

Republic of Indonesia. MOT will assign its own staff as the financial officer for the Project, who will support the preparation of the Project interim un-audited financial statement of the Project on quarterly basis. The payment verification will be conducted under the finance unit of DGST, MOT.

### **C. Implementing Entities**

The Project will engage the three littoral states, Indonesia, Malaysia, and Singapore and a number of international governmental and non-governmental organizations. Given the number of counterparts, the Project will rely upon a Project Steering Committee to provide guidance, review the Project progress and resolve obstacles to Project implementation. The implementing agencies will be the International Maritime Organization and the Indonesia's Ministry of Environment. The implementation arrangements for the Project are presented in Annex 6.

### **D. Funds Flow**

International Maritime Organization. For the activities implemented by IMO, the grant funds will be disbursed from the Bank to the IMO in London. IMO will then make all necessary payments. There are no counterpart funds involved in IMO's Project activities since all activities are fully financed by the GEF Grant. IMO will use report-based disbursement procedures using Financial Monitoring Reports (FMR). All documentation for the expenditures as reported in the FMR would be retained at the IMO and shall be made available to auditors for the annual audit and to the Bank, as requested. The Bank's disbursement would be for the six months projected expenditures as reported in the FMR.

Republic of Indonesia. The Ministry of Transport (MOT) funds flow will follow the common arrangement for donor-financed projects in Indonesia. A Special Account specifically for the Project will be open by Ministry of Finance. The World Bank will deposit funds to the Special Account as requested based on the Project quarterly FMR. To effect payments, the Head of Satker at the MOT, with the assistance of the commitment maker and finance officer prepares SPP (Surat Permintaan Pembayaran or Payment Request) for verification (for its eligibility to the budget and documentation completeness) by the finance bureau within MOT who then issues SPM (Surat Perintah Membayar or payment order). The finance unit then submits the SPM to KPPN (Treasury Office of Ministry of Finance), who in turn issues an SP2D (Bank transfer instruction) to the central bank/ government bank. The payment will then be transferred directly to the account of the respective vendor or consultant or contractor. Direct payment from the Bank can also be processed as requested of the MOT with Ministry of Finance consultation.

### **E. Staffing**

As indicated above, IMO has sufficient qualified staff to carry out the financial management functions imposed by the GEF Grant to IMO. The financial management function of the Project will be handled by a Finance Officer in both IMO and MOT.

### **F. Accounting Policies and Procedures**

International Maritime Organization. IMO accounts are maintained in accordance with its Financial Regulations on an accrual basis. The Financial Regulations are adopted by the IMO Assembly and are acceptable to the IMO Member States and other donors who finance IMO activities. Externally-financed projects are subject to the same internal controls and reporting as all other IMO funds. The IMO operates on a biannual financial period, with annual audited

financial statements. The IMO finance unit is responsible for the accounting and reporting on a large number of externally-financed projects. IMO implements projects financed by bilateral and multilateral donors, including France, United Kingdom, Japan, United States, European Commission and United Nations agencies. IMO has sufficient capacity to take on the accounting for the MEH Demonstration Project.

Republic of Indonesia. MOT will follow the government standardized accounting policies and procedures. The transactions will include limited payments of four procurement packages of equipment and their maintenance through out the period of the Project implementation.

**G. Internal Audit**

MOT has its own internal audit unit, the Inspectorate General, which has a right to conduct an audit assignment to the Project. The respected Inspectorate General mostly conducts operational audits on all units under MOT, including Loan/Credit/Grant financed by donor agencies.

**H. External Audit**

International Maritime Organization. As part of the United Nations, IMO is subject to the usual United Nations audit requirements and procedures. IMO is currently audited by the Comptroller and Auditor General of India and received an unqualified opinion on its financial statements for the year ended December 31, 2004. The audited entity financial statements include an annex with details for each of the numerous donor-financed projects implemented by the IMO. This IMO entity audit report and auditor are considered acceptable to the Bank.

Republic of Indonesia. The MOT Project audit will be the annual Project accounts to be prepared based on the quarterly FMRs. The MOT shall prepare the Project financial statement, including disclosure of the special account, for audit by independent auditor acceptable by the Bank. The annual audit report will be furnished to the Bank not later than six months after the end of the government’s fiscal year (June 30).

The audit requirement for this Project will be:

Type of Audit Report	Implementing Entity	Due Date
Entity financial statements	International Maritime Organization	Six months after IMO’s fiscal year end (June 30)
Project Financial Statement	Ministry of Transport, Republic of Indonesia	Six months after the end of the Government fiscal year (June 30)

**I. Reporting and Monitoring**

International Maritime Organization. Financial Monitoring Reports (FMR) will be submitted on a quarterly basis by IMO. The format of the FMR will be aligned with the normal periodic financial reports prepared by IMO for each of its externally-financed projects. The format of the normal IMO annual financial statements is acceptable. IMO prepares annual financial statements for the entire organization, including annexes with detailed financial reports on each

externally-financed project. This format will provide a sufficient level of information to the Bank.

Republic of Indonesia. Financial Monitoring Reports (FMR) will be submitted on a quarterly basis by Ministry of Transport within 45 days of the end of the reporting quarter. For MOT, the FMR format would cover the following:

(i) *Financial Report*

(ii) *Output Monitoring Report*

(iii) *Procurement Management Report*

The first report will cover the planning part of the report including Report 1-C Project Cash Forecast, Report 3-A and 3-B for the amount of initial deposit required for the first six months of Project implementation.

## **J. Information Systems**

IMO has suitable computerized information systems. However, MOT does not have computerized accounting system at the Project level. The Financial Monitoring Reports will be prepared by MOT using a simple Microsoft Excel program.

## **K. Disbursement Arrangements**

A Special Account denominated in US Dollars will be established at and maintained by IMO for this Project. Also, a Special Account denominated in US dollars will be opened in the Central Bank of Indonesia under the name of Ministry of Finance. The World Bank's disbursement would be for the six months projected expenditures as reported in the FMRs. The management of the Special Accounts would essentially be the responsibility of the Administrative Division of IMO (assisted by PMO in Batam) and the MOT in Indonesia. Disbursements from the Bank would be made to the Special Accounts based on the submission of the FMRs prepared by the Administrative Division of IMO together with the PMO and the MOT in Indonesia. All documentation for the expenditures as reported in the FMRs would be retained at the PMO and the MOT and shall be made available to auditors for the annual audit and to the Bank during the supervision missions.

The table below shows the estimated disbursements by quarter from the Grants to each of Republic of Indonesia and the International Maritime Organization (IMO).

**Disbursement of Republic of Indonesia and IMO Grants (US\$ million)**

Calendar Year and Quarter	Indonesia disbursement	Indonesia cumulative disbursement	IMO disbursement	IMO cumulative disbursement	Total disbursement	Total cumulative disbursement
2006 ii	0.00	0.00	0.00	0.00	0.00	0.00
2006 iii	0.30	0.30	1.05	1.05	1.35	1.35
2006 iv	0.50	0.80	1.76	2.81	2.26	3.61
2007 i	0.50	1.30	1.76	4.57	2.26	5.87
2007 ii	0.05	1.35	0.18	4.74	0.23	6.09
2007iii	0.05	1.40	0.18	4.92	0.23	6.32
2007iv	0.04	1.44	0.14	5.06	0.18	6.50
2008 i	0	1.44	0.30	5.36	0.30	6.80
2008 ii	0	1.44	0.30	5.66	0.30	7.10
2008 iii	0	1.44	0.30	5.96	0.30	7.40
2008 iv	0	1.44	0.30	6.26	0.30	7.70
2009 i	0	1.44	0.30	6.56	0.30	8.00
2009 ii	0	1.44	0.30	6.86	0.30	8.30

**L. Global Environment Facility Grant Allocation**

Allocation of the Global Environment Facility (GEF) Grant proceeds to International Maritime Organization and Republic of Indonesia will be according to the following schedule:

**Allocation of Grants to International Maritime Organization and Indonesia by Category**

Category	International Maritime Organization	Republic of Indonesia	Total GEF	% of eligible expenses to be Financed
Goods	464,000	1,310,000	1,774,000	100%
Consultant's services	4,664,000	0	4,664,000	100%
Incremental operating cost	672,000	0	672,000	100%
Management (IMO)	500,000	0	500,000	100%
Unallocated (except management fee)	560,000	130,000	690,000	100%
Total	6,860,000	1,440,000	8,300,000	100%

**M. Supervision Plan**

The Bank will undertake implementation review of the Project on average once every six months. This will include review of financial aspects of the Project, including review of the Project's financial management and disbursement arrangements, quarterly financial monitoring reports, Special Account, annual audited financial statements and auditor's management letter.

## **Annex 8: Procurement Arrangements**

### **Marine Electronic Highway Demonstration Project**

#### **A. General**

Procurement for the proposed Project would be carried out in accordance with the Bank's "Guidelines: Procurement under IBRD Loans and IDA Credits" dated May 2004; and "Guidelines: Selection and Employment of Consultants by World Bank Borrowers" dated May 2004, and the provisions stipulated in the Grant Agreements. The various items under different expenditure categories are described below. For each contract to be financed by the Grants, the different procurement methods or consultant selection methods, the need for pre-qualification, estimated costs, prior review requirements, and time frame are agreed between the International Maritime Organization (IMO) and the Ministry of Transport (MOT) of the Republic of Indonesia and the Bank in the Procurement Plan. The Procurement Plan will be updated at least annually or as required to reflect the actual Project implementation needs and improvements in institutional capacity.

**Procurement of Works:** No works will be procured using funds from the Grants under this Project. However, a small amount of civil works will be procured by the Government of Indonesia using its own resources and procurement procedures.

**Procurement of Goods and non Consulting Services:** Goods and non consulting services estimated to cost US\$200,000 or more will be procured through International Competitive Bidding (ICB). Goods estimated to cost less than US\$200,000 may be procured through Shopping on the basis of at least three written quotations obtained from qualified suppliers.

**Selection of Consultants:** Consultant services to be provided by consultant firms estimated to cost US\$100,000 or more will be procured through Quality and Cost Based Selection (QCBS) method. Consultant services to be provided by consultant firms estimated to cost less than US\$100,000 may be procured through Consultants' Qualifications (CQS) method. Individual Consultants will be selected in accordance with Section V of the Consultant Guidelines.

**Operating Costs:** The operating costs for the Project Management Office (PMO) covering office supplies, utilities, operating and maintenance expenditures of equipment and vehicles, fuel, communication, utilities, travel expenses, among others, will be disbursed on the basis of annual budgets to be prepared by the IMO and agreed with the Bank.

The World Bank's Guidelines, Standard Bidding Documents to be used for each procurement method, as well as Consultant Selection documents were provided to the implementing agencies and the updated documents are available in the Bank's external web-site.

#### **B. Assessment of the agency's capacity to implement procurement**

International Maritime Organization (IMO). The IMO will be responsible for the procurement of Goods and Consultant Services. The procurement under the grant for IMO will be implemented by IMO, either through its Headquarter office or the PMO in Batam. The technical specifications

or Terms of Reference as the case may be, will be developed by the relevant Technical Committee. In the case of items to be prepared during the first year of implementation, the specifications were prepared by a consultant hired by IMO (acceptable to the Bank) during implementation of the PDF Block B grant. These specifications will be reviewed and the bid documents prepared by IMO. Procurement oversight within IMO is done through the IMO's Internal Auditor. In addition, there is also an audit conducted by external Auditors.

Republic of Indonesia. The Office of the Deputy Minister for Nature Conservation Enhancement and Environmental Destruction Control of the Ministry of Environment is the coordinating Ministry for the Project. The Directorate General of Sea Transport of the Ministry of Transport is the implementing agency and will undertake all the procurement required for Indonesian part of the Project, namely four goods packages (Tidal Stations, DGPS Base Station, two AIS Base Stations, and Ocean Buoys). The Hydro-Oceanographic Service of the Navy of the Recipient will be responsible for the maintenance and operation of the tidal stations and the Directorate General of Sea Transport will be responsible for the maintenance and operation of the remaining equipment procured under the Project. Furthermore the Hydro-Oceanographic Service will represent the Republic of Indonesia in the hydrographic surveys and the production of Electronic Navigation Charts to be carried out by the International Maritime Organization.

Disclosure. To support the disclosure policy pilot by the Bank and Indonesia, it is agreed that the Project is adopting the greater disclosure of information to the public. Guidelines on disclosure of information to the public on project and procurement activities include the following key actions:

- (a) The IMO and Indonesia will and the Bank may make publicly available, promptly after completion of a mid-term review of the project carried out in accordance with the grant agreement, the mid-term review report and the aide-memoire prepared for this purpose.
- (b) The IMO and Indonesia will and the Bank may make publicly available promptly after receipt all final audit reports (financial or otherwise, and including qualified audit reports) prepared in accordance with the grant agreements and all formal responses of the government in relation to such reports.
- (c) The IMO and the Indonesia (and the Bank) will:
  - Make publicly available promptly after finalization the Procurement Plan and schedules, including all updates thereof;
  - Make available to any member of the public promptly upon request all bidding documents and requests for proposal issued in accordance with the procurement provisions of the Grant Agreements, subject to payment of a reasonable fee to cover the cost of printing and delivery. In the case of request for proposals, the relevant documents will only be made available after notification of award to the successful firm. Each such document will continue to be made available until a year after completion of the contract entered into for the goods or services in question;

- Make available to any member of the public promptly upon request all shortlists of consultants and, in cases of pre-qualification, list of pre-qualified contractors and suppliers.
- Disclose to all bidders and parties submitting proposals for specific contracts, promptly after the notification of award to the successful bidders / consultants, the summary of the evaluation of all bids and proposals for such proposed contracts. Information in these summaries will be limited to a list of bidders / consultants, all bid prices and financial proposals as read out at public openings for bids and financial proposals, bids and proposals declared non responsive (together with reasons for such an assessment), the name of winning bidder / consultant and the contract price. Such summaries will be made available to the public, promptly upon request.
- Make publicly available and publish widely, contract award information for all contracts, promptly after such award; and
- Make available, promptly upon request by any person or company, a list of all contracts awarded in the three months preceding the date of such request in respect of a project, including the name of the contractor / supplier / consultant, the contract amount, the number of bidders / proposes, the procurement method followed and the purpose of the contract.

Record-keeping: There is a mandatory requirement for maintaining written records of procurement within both the IMO and Indonesia, however, they are not available to the general public. All documents related to procurement activities will be mandated to be kept at the Project Management Office during the course of the Project. With the use of the Bank Guidelines in this Project, procurement documents will be made available to the public.

Staffing: Staff/Procurement Officers will be appointed in IMO and MOT to act as the focal points on procurement issues during the course of the Project. The Procurement Officers in IMO and MOT will provide the necessary coordination and management of procurement activities in each of the Implementing Units.

The assessment of procurement risk in this Project is rated as ‘average’ due to the following reasons:

- (a) Procurement activities consist of a limited number of packages, e.g. 8 goods, 1 non consulting services and about 19 consultancy services packages (out of which six are for firms, while the remaining are individuals);
- (b) Six packages of goods and non consulting services will be procured through International Competitive Bidding and three packages through Shopping;
- (c) Technical Committees will be established, with representatives of each of the Implementing Agencies, who will prepare the specifications of the procurement packages;

- (d) An interim Project Launching Consultant will be recruited by IMO for the initial period of the Project to expedite preparation while the selection of the Project Manager is being processed. A Procurement Consultant will be hired to assist the project in its procurement plan, in particular, for the first year of implementation. IMO has a procurement section IMO has a procurement division which is familiar with the United Nations system, but has little experience with World Bank procurement procedures. IMO procurement staff will be trained in Bank procurement procedures prior to start up of Project implementation.

The agreed Procurement Action Plan to mitigate the “average” risk is given below.

### **Procurement Action Plan**

<b>Action</b>	<b>Responsibility</b>	<b>Completion Dates</b>
<i>Capacity enhancement by adding capacity</i>		
1. Head of General Services at IMO will coordinate and manage procurement under the respective Grants	IMO	Completed
<i>Enhanced planning and controlling mechanisms</i>		
2. The draft procurement plan for the overall Project has been prepared and will be finalized prior to effectiveness. Updates of the Procurement Plan will be incorporated when required.	IMO,MOT	Included in PIP
3. The Bank’s Standard Bidding Document and Standard Request For Proposals will be used for the Project. These will be prepared by the IMO prior to implementation of procurement.	IMO, MOT	Included in PIP and Grant Agreements
4. The prior review threshold is set lower than the maximum prior thresholds for average risk projects.	IMO, MOT	Completed
5. The Project will adopt a disclosure policy to increase public accountability of the Project.	IMO, MOT	Included in PIP

### **C. Procurement Plan**

To anticipate the procurement activities under this Project, a Procurement Plan was prepared by the IMO. This Procurement Plan provides the basis for the procurement methods and includes all packages that are anticipated under the Project, covering the whole period of implementation. Any updates to the Plan will be incorporated accordingly as required throughout the Project period. The Procurement Plan will be available in the Project’s database and in the Bank’s external website, and will be updated in agreement with the task team annually or as required to reflect the actual Project implementation needs.

### **D. Frequency of Procurement Supervision**

In addition to the prior review supervision to be carried out from World Bank offices, the capacity assessment of the implementing agencies has recommended a yearly supervision mission to visit the field to carry out post review of procurement actions.

## E. Details of the Procurement Arrangements

### 1. Goods

(a) List of goods contracts and the non consultancy services packages and method of procurement is shown below:

#### Procurement of Goods Including Non-Consulting Services

1	2	3	4	5	6	7	8	9
Ref. No	Contract (Description)	Estimated Cost US\$	Procurement Method		Domestic Preference (yes/no)	Review by Bank (Prior / Post)	Expected Bid-Opening Date	Comments
1	Supply and Installation of Marine Tech Infrastructure: Tide Stations	210,000	ICB	1 package consisting of: 3 units for 3 locations	No	Prior	October 2006	Procured by GOI-DGST
2	Supply and Installation of Marine Navigation Infrastructure: i) DGPS Beacon Station ii) AIS Base Stations iii) Ocean Data Buoy	1,100,000 <i>300,000</i> <i>250,000</i> <i>550,000</i>	ICB	1 unit 2 units 1 unit	No	Prior	January 2007	Procured by GOI-DGST
3	Computer Server	84,000	Shopping	2 units	No	Post	December 2006	Procured by IMO
4	Procurement of Software i) ENC Production Software ii) Modeling Software	360,000 <i>60,000</i> <i>300,000</i>	Shopping ICB	6 licenses 1 license	No	Prior	March 2007 Sept, 2007	Procured by IMO
5	Office Equipment	20,000	Shopping	1 lot	Yes	Post	October 2006	Procured by IMO
6	Hydrographic Survey	2,810,000	ICB for non-consulting services		No	Prior	January 2007	Procured by IMO
	Total goods	4,584,000						

(b) ICB contracts estimated to cost above US\$ 200,000 per contract or more and the first shopping contract by Indonesia will be subject to prior review by the Bank.

## 2. Consulting Services

(a) List of consulting assignments and method of procurement is shown below:

### Procurement of Consulting Services

No	Contract	Estimated Cost (US\$)	Selection method	Review by Bank	Duration (Months)	Advert/ Invitation
1	Implementation advisor	72,000	IC	Prior	5 months	April, 06
2	Procurement Consultant	24,000	IC	Post	3 months	April, 06
3	Project Manager	388,000	IC	Prior	48 months	June, 06
4	Administrative Assistant	95,000	IC	Post	47 months	Sept, 06
5	Baseline survey	60,000	CQS	Post	4 months	October, 06
6	Network Manager/ Webmaster	60,000	IC	Post	4 months	October, 06
7	Data Center advisor	144,000	IC	Prior	18 months	Dec, 06
8	Maritime specialist	108,000	IC	Prior	15 months	January, 07
9	Maritime Environment Specialist	72,000	IC	Post	9 months	March, 07
10	MIO symbology	300,000	QCBS	Prior	12 months	March, 07
11	Economic and Financial Evaluation	41,000	IC	Post	5 months	March, 07
12	Systems manger	70,000	IC	Post	5 months	May, 07
13	Emergency Response System Design	30,000	CQS	Post	5 months	May, 07
14	Hydrodynamic model	200,000	QCBS	Prior	8 months	June, 07
15	Oil spill model	100,000	QCBS	Post	6 months	June, 07
16	Maritime economist	60,000	IC	Post	8 months	July, 07
17	MEH System Evaluation	41,000	IC	Post	11 months	August, 07
18	Sand wave model	110,000	QCBS	Prior	11 months	January, 08
19	System Development Action Plan	34,000	IC	Post	10 months	October, 08
	Estimated total cost	2,009,000				

Procurement methods for Consulting Contracts:

QCBS = Quality and Cost Based Selection

IC = Individual Consultant

CQS = Selection Based on Consultants Qualifications

(b) Consultant services estimated to cost US\$100,000 or more per contract for the selection of consultants (firms) and individual consultant assignments estimated to cost US\$100,000 or more will be subject to prior review by the Bank as well as the first contract for the selection of a firm using CQS and the first contract for selection of an individual consultant regardless of value.

## **Annex 9: Economic and Financial Analysis**

### **Marine Electronic Highway Demonstration Project**

There are three potential impacts of the Marine Electronic Highway (MEH) that will result in benefits to the littoral states and ship operators. First there will be a reduced risk of collisions and groundings of ships, that will reduce the damage repair costs to ship operators (or in financial terms, might result in reduced insurance premiums) and reduced costs of the clean-up of oil spills to the littoral states, and less risk of interference to their maritime based economic activities, mostly fishing and tourism. A further advantage, namely that of reduced impact of deliberate spills and illegal discharges of oil and waste from passing ships, has not been quantified. This will be attempted with the more detailed data that will be collected during the course of the MEH Demonstration Project. Second, operators of the largest oil tankers will be able to load their vessels with more oil, reducing the number of voyages and ship operating costs, as well as further reducing the risk of collisions and groundings. There will also be reduced risk of damage to the rich environmental resources of the Straits of Malacca. It is also possible that reducing the risk of piracy will also be facilitated by some of the components of the MEH. However, management of this risk is not one of the objectives of the MEH and will be dealt with separately by the littoral states (they have recently declined Japanese assistance in this respect) and so has not been evaluated as a benefit of this project. A final potential benefit, and another that has not been evaluated, is that of increased capacity of the shipping lanes of the Straits, so that in the long term future, fewer ships will be forced by capacity constraints to make longer voyages using alternative routes.

The scale of all of these benefits is proportional to the related number, type and size of ships passing through the Straits, so the first section of this Annex is a projection of shipping in the Straits.

#### **Shipping in the Straits of Malacca and Singapore**

Although growth in the volume of shipping stagnated in 2003 at just over 62,000 ships, over the period 1999 to 2003 the average annual rate of growth was over 9 percent. The two most significant types of ships passing through the Straits are oil tankers and container ships, with the number of the latter surpassing that of the former for the first time in 2002. Between them, they account for more than two thirds of the total movements. There are therefore two drivers of growth in the volume of shipping through the Straits namely demand for oil and the volume of world trade, particularly exports from East Asia.

#### **Oil demand and tanker movements**

China<sup>2</sup> recently passed Japan as the world's second highest oil consumer after the United States, and the fifth largest oil importer (Japan is second after the United States and South Korea is fourth). Some of the regions current net exporters, including Malaysia, will soon become net importers. Current East Asia demand for oil of about 21 million barrels per day is expected to

---

<sup>2</sup> China's Demand for Oil may make Thailand Canal a Reality, Global news, July 22, 2003  
[http://www.wbai.org/artman/publish/artilcle\\_505.php](http://www.wbai.org/artman/publish/artilcle_505.php)

increase to 38 million barrels per day between 2001 and 2025, a long term growth of more than 3.5 percent per year. However, as regional production is expected to remain constant at about 8 mbd, imports will need to grow at nearly 5 percent to satisfy demand.

The Middle East currently supplies about 65 percent of East Asia's oil, and despite the emergence of alternative sources such as Kazakhstan and Siberia that could supply East Asia by pipeline, the Middle East's contribution is expected to increase to more than 75 percent<sup>3</sup>. Already fears that the Malacca Straits could become a bottleneck for this flow of oil are leading to a revival of ideas of alternative routes such as the Kra Canal through the Thailand Peninsula, however such projects are at least two decades away from realization<sup>4</sup>.

#### **Number of Ship Movements recorded by the STRAITREP System**

<b>Month</b>	<b>1999</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>
January	2,554	4,174	5,013	5,167	5,152
February	2,703	4,212	4,509	4,627	4,616
March	3,386	4,569	5,119	5,169	5,156
April	3,312	4,518	4,902	5,057	4,972
May	3,465	4,797	5,006	4,989	5,156
June	3,668	4,683	4,807	4,843	4,905
July	3,905	4,932	5,056	5,260	5,265
August	4,120	4,995	5,066	7,482	5,470
September	4,055	4,713	4,848	4,970	5,390
October	4,345	4,863	5,084	4,996	5,472
November	4,224	4,697	4,871	4,908	5,309
December	4,227	4,802	5,033	4,925	5,471
<b>Total</b>	<b>43,964</b>	<b>55,955</b>	<b>59,314</b>	<b>62,393</b>	<b>62,334</b>

Oil tankers make up just under one third of the total vessels passing the Straits, and of these about 20 percent are either ultra large crude carriers (ULCCs) and very large crude carriers (VLCCs) of over 250,000 dead weight tons. They are currently limited in the amount of oil they can carry by the depth constraint of the Malacca Straits. The maximum depth for these vessels in the eastbound channel of the Straits is 21 meters.

In 2002 there were 2,258 Eastbound transits of the Malacca straits by VLCCs, about one third of them ULCC oil tankers of 250,000 dead weight tons or more, and they transported an average of about 246,500 tons of oil per vessel on each voyage. These ULCCs are currently constrained in the amount of oil they can carry by the limited depth of the Malacca Straits as there does not appear to be any constraint at either their loading or discharging ports. However, neither the maximum or average size of ULCCs passing through the Straits is expected to increase in the foreseeable future, so the number of tankers transiting the Straits is likely to grow at the same rate as oil imports from the Middle East, other than the impact of the MEH on allowing a greater loading of ULCCs.

<sup>3</sup> Long-term view and Strategic issues on Oil Supply-Demand in Asia, Northeast Asia Petroleum Forum, November 2003, [http://www.wbai.org/artman/publish/article\\_505.php](http://www.wbai.org/artman/publish/article_505.php)

<sup>4</sup> Asia's Energy Insecurity is a Dilemma for the U.S., Asian Wall Street Journal, March 22, 2004.

With demand for oil exports through the Straits expected to grow by 5 percent per year, and average size to increase by 3 percent per year, the number of ship movements would grow by 2 percent per year, reaching some 30,000 transits by 2025. Of these, almost 90 percent (27,000) would be ULCCs of over 250,000.

**Demand and Supply for Oil Products in East Asia  
(thousands of tons)**

Country	1999			2020		
	Demand	Supply	Deficit	Demand	Supply	Deficit
Brunei	428	9,712	-9,284	1,109	11,204	-10,095
China	204,291	159,896	44,395	497,249	151,886	345,363
Chinese Taipei	38,227	44	38,183	51,085	0	51,085
Hong Kong	11,241	0	11,241	23,876	0	23,876
Indonesia	46,666	70,053	-23,387	100,023	42,040	57,983
Japan	266,438	746	265,692	288,359	0	288,359
Korea	99,913	446	99,467	163,045	446	162,599
Malaysia	22,231	37,348	-15,117	52,129	32,874	19,255
Philippines	17,682	41	17,641	36,996	1,124	35,872
Singapore	21,218	0	21,218	27,842	0	27,842
Thailand	33,859	4,138	29,721	73,117	3,560	69,557
Vietnam	7,532	15,331	-7,799	32,238	30,529	1,709
Total	769,726	297,755	471,971	1,347,068	273,663	1,073,405

*Source: Asia Pacific Energy Research Center*

**Trade Demand and Container Ship Movements**

World container trade reached about 55 million Twenty foot Equivalent Units, TEUs, in 2002 (excluding empty and transshipment containers), and East Asian –Europe container had been growing at more than 10 percent per year for at least a decade.<sup>5</sup> Loading volume in the region made up 40 percent of the world total, but unloading made up only 28 percent, indicating East Asia’s high trade dependence on exports. While most East Asia exports are on the trans-Pacific routes, about 30 percent are on the routes to Europe. Most, if not all, container ships en route from East Asia to Europe, the Middle East and Africa pass through the Straits. There are also a number of container ships on intra-Asia trade, North –South routes and on feeder routes to Singapore, Port Klang and Tanjung Pelepas. Container ships on these routes currently make up about 30 percent of the total movements through the Straits. Projections of the largest of these movements, those from East Asia to Europe, are rather inconsistent, with long term growth rates varying between 5 percent and 10 percent.

In 2003 these container ship movements through the Straits totaled about 20,000. In projecting the future number, not only is it necessary to project the total container trade on these routes, but

<sup>5</sup> Container Trade Supply Demand forecasts for Three Major east-West Trades, Research Office, Mitsui O.S.K Lines <http://www.mol.co.jp/research-e/report/annualreport2001.pdf>

also the rapidly increasing average ship size, and the uncertain prospects for what has become known as the Malacca –max design. While the average number of containers carrier per ship is relatively low at less than 2,500 per ship, the largest container vessels presently using the Straits can carry up to 8,500 containers, and this is probably the largest economically feasible for a single screw vessel that can maintain current speeds and schedules. The next step up would be to a double screw vessel, and if operated within the current constraints of the Malacca Straits would be of about 250,000 gross tons and able to carry perhaps 15,000 containers. Although some sources consider such a ship to be already technically and financially feasible, most experts consulted do not believe that such a large container vessel will be operating for at least another decade. So if the projections of about 8 million Twenty foot Equivalent Units of containers to be transported westward through the Straits are to be realized, and the average ship size increases to 5,000 Twenty foot Equivalent Units, this would require 1,600 passages per year, or taking into account the return voyages, almost 100 passages per day.

### **Total Ship Movements**

Many different ship types make up the remaining number, including general cargo, mixed cargo, ore and grain carriers, and a few passenger ships that have not been deterred by the recent piracy attacks. If the numbers of these ships are assumed to increase at their historic rate of about 3.5 percent per year, and the resulting number is added to the projections of oil tankers and container ships, the projected total for the year 2025 is almost double that recorded in 2003, representing an average growth rate of about 3 percent.

### **Actual and Projected shipping movements in the Malacca Straits**

<b>Ship type</b>	<b>2002</b>	<b>2025</b>
Non Very Large Crude	17,400	30,000
Ultra Large Crude Carriers	3,300	16,500
Container ships	23,000	34,200
Malacca Max	0	3,800
Other	18,600	41,000
<b>Total</b>	<b>62,300</b>	<b>125,500</b>

*Source: World Bank estimates*

## **Reduced accident risk and cost**

Previous research on risk assessment of tankers in the Straits<sup>6</sup> has shown the risk of accidents to tanker traffic of approximately 0.029 percent per tanker passage through the Straits. The risk of a major spill has been estimated at 10 percent of this, that is about 0.0029 percent per tanker. There are several interacting characteristics of the MEH that could affect the probability of an oil spill. First, the availability of accurate Electronic Navigation Charts and other electronic navigation aides will allow more reliable navigation, which would reduce the risk. There is however a chance that with the additional electronic measures available, more risks would be taken thereby increasing the risk of a grounding, collision or spill. If the MEH allows a reduction in the under keel clearance, it is reasonable to assume that this would still result in a reduction in the risk of a grounding, compared to the operation of an unequipped vessel operating with the existing under keel clearance. Combining these effects, it might be expected that the overall risk of a major spill would reduce by at least 10 percent with the introduction of the MEH.

There is not much economic or financial quantification of the costs of oil spills in the Straits. One accident for which substantial evidence is available is used as the source for the reduced costs of future accidents. The Natuna Sea incident, which occurred in October 2000, resulted in a spill of about 7,000 tons or about 46,000 barrels of oil. The total clean-up cost was about US\$127 million, made up of US\$102 million compensation to Indonesia for environmental damage, about US\$10 million in compensation, again mostly to Indonesia for fishing-related compensation and about US\$15 million in clean-up costs, mostly incurred by Singapore. This is equivalent to about US\$18,000 per ton of oil spilt, which is the unit cost used here.

## **Economic Evaluation**

Taking the situation in 2002 as a base case, there were 20,700 transits of tanker vessels (excluding LNG/LPG carriers). The average size of oil spills in the Malacca Straits in the period 1975 to 1997 was 5,680 tons, and using the average clean-up cost of US\$18,000 per ton of oil spilt with a total expected cost of about US\$60 million per year. If the number of spills had been reduced by 10 percent this would have resulted in a saving of some US\$6 million per year. Since about half of the coastline of the Straits is in Malaysian territory and about half in Indonesian territory, these benefits would have been approximately equally divided between these two littoral states.

When the same unit costs are applied to the projected number of tanker voyages through the Straits, and the investment costs are taken to include operating and maintenance and resurveying every four years, the net present value is about US\$26 million (using a discount rate of 12 percent), the economic rate of return (ERR) is about 32 percent and the modified economic rate of return (using a rate of return of 12 percent for reinvested benefits) is about 21 percent. These values are robust to projections in the number of voyages, even with a continuation of the 2002 number of voyages the evaluation results are US\$13 million for the net present value, 24 percent for the ERR and 18 percent for the ERR. The switching value for costs (the cost increase needed to result in a zero net present value) is an increase of about 240 percent, or for the benefits to be

---

<sup>6</sup> Malacca Straits: Refined Risk Assessment, PEMSEA, 1999

reduced to 43 percent of their estimated value, or for costs to increase by 45 percent while benefits reduce to 65 percent.

### Summary of Economic Evaluation Results

	Net Present Value	Economic Rate of Return	Modified Economic Rate of Return
Basic values	US\$26 million	32%	21%
Constant voyages	US\$13 million	24%	18%
Switching values	Cost + 240%	Cost + 240%	Cost + 240%
	Benefits 43%	Benefits 43%	Benefits 43%
	Cost +145%, Benefits	Cost +145%, Benefits	Cost +145%, Benefits

Source: World Bank estimates

These are conservative estimates as they do not allow for any benefits arising from reducing the minimum required under-keel clearance or other benefits stemming from the MEH such as reductions in minor oil spills and damage to vessels as a consequence of improved safety, less congestion in the Straits, avoidance of the dumping of ships' waste & bilge, enhanced speed of response to incidents, greater levels of real time information, reduced risks of loss of cargo and fatal & non-fatal injuries to seafarers.

### Reduced Under-keel Clearance

A further benefit stems from a possible reduction, if agreed, in the minimum required under-keel clearance from 3.5 meters to 3.0 meters because of the more accurate and up-to-date hydrographic information and availability of ENCs and other electronic navigation aids. This should lead to increased loads for any tankers which are currently draft constrained<sup>7</sup> (namely VLCC vessels over 250,000 dead weight tons) resulting in fewer transits of the Straits.

In 2002, there were about 17,400 transits by conventional tankers and they carried an average of about 80,000 tons per transit and 3,300 transits by VLCCs that carried an average of 246,500 tons of oil per transit. If the under keel clearance were to be reduced to 3.0 meters, the ULCCs would have been able to transport about an additional 16,500 tons per laden voyage. That is, the same amount of oil that in 2002 was transported in 1,000 transits by VLCCs could be transported in 938 transits, a reduction of 62 laden transits.

These 62 transits would imply a saving of eight vessels employed only in the Middle East to Far East trade. For these vessels the running costs per vessel are about US\$7.8 million per year (about US\$62.4 million for 8 vessels) and the fuel cost savings of the 62 voyages would be a further US\$33 million per year, giving an annual saving for the 2002 volume of oil transported of US\$95.8 million. Using the same vessel operating costs, but the 2020 volume of oil

<sup>7</sup> The authors have found no evidence that an extra 0.5 meters of draft would pose any difficulties for VLCCs transiting the Malacca Straits and bound for ports in China, Japan or South Korea, since both China and South Korea have ports that can accommodate ULCCs and China has some facilities that can accommodate VLCCs carrying up to 270,000 tons of crude oil (Lloyd's Register -Fairplay Ports and Terminals Guide 2003-2004, various Drewry Monthly Reports).

transported, would give a saving of about 1,000 voyages, equivalent to about 129 vessels and annual cost saving for that year of about US\$1.27 billion.

The size of these financial benefits to ship operators is an indication of the opportunities for implementing a voluntary charging system for the MEH.

### **Additional Reduced Risk of Collision or Grounding**

The saving in voyages would further reduce the cost of accidents by reducing the number of voyages through the Straits. This would have amounted to about US\$0.17 million in 2002 and will be about US\$2.69 million by 2020.<sup>7</sup> (Note that, in these calculations, the risk of accidents has been reduced by 10 percent to allow for the increased safety in navigation of vessels arising from the operation of the Marine Electronic Highway (MEH)).

The estimates assume that when the MEH is operational most ships passing through the Straits will be fitted with Electronic Chart Display and Information Systems even though the net benefits accruing to ship owners from doing so could not be quantified<sup>8</sup>.

#### References:

- [1]. Traffic figures 2002 for the Malacca and Singapore Straits come from [www.marine.gov.my/misc/statistic/kp\\_2002](http://www.marine.gov.my/misc/statistic/kp_2002).
- [2]. Marine Pollution Management in the Malacca/Singapore Straits: Lessons Learned. Published by GEF/UNDP/IMO Regional Program for the Prevention and Management of Marine Pollution in the East Asian Seas. March 1998. Table 13 p25
- [3]. Malacca Straits: Initial Risk Assessment prepared by Peter Calow and Valery Forbes for the GEF/UNDP/IMO Regional Program for the Prevention and Management of Marine Pollution in the East Asian Seas. March 1997. Table 20 and pp61-63
- [4]. Marine Pollution Management in the Malacca/Singapore Straits: Lessons Learned. Published by GEF/UNDP/IMO Regional Program for the Prevention and Management of Marine Pollution in the East Asian Seas. March 1998. Table 25 p103
- [5]. Traffic figures 2002 for the Malacca and Singapore Straits come from [www.marine.gov.my/misc/statistic/kp\\_2002](http://www.marine.gov.my/misc/statistic/kp_2002).
- [6]. Swinnerton R. A description of regional shipping routes: navigational and operational considerations. December 1994. Table 4 p3.
- [7]. Marine Pollution Prevention Management in the East Asian Seas: a Benefit-Cost Framework. Published by GEF/UNDP/IMO Regional Program for the Prevention and Management of Marine Pollution in the East Asian Seas. March 1999. pp22-24.

---

<sup>8</sup> A sensitivity analysis was conducted which showed that the estimated total cost per barrel spilt could fall to below US\$1900 before the NPV became zero or alternatively the reduction in the risk of a major oil spill could fall to 6.9 percent for the same effect.

### Unit Costs of oil spills

This cost was derived from the Natuna Sea incident that occurred in October, 2000. The estimated size of spill was 7,000 tons, equivalent to 46,340 barrels.

Country	Costs claimed in US \$	Category
Singapore	12,751,196	Clean-up
Malaysia	342,106	Clean-up
Indonesia	2,051,822	Clean-up
Singapore	81,766	Fishing – related
Malaysia	238,159	Fishing – related
Indonesia	9,807,666	Fishing – related
Indonesia	101,730,500	Environmental damage
Total Cost	127,003,225	

Cost per ton = US\$ 127,003,225/7000

= US\$ 18,143.32

Cost per barrel = US\$ 18,143.32/6.62

= US\$ 2,740.68

*Source: 2001 Annual Report of the International Oil Pollution Compensation Funds*

### Very Large Crude Carrier operating costs (US \$)

The figures are based on a vessel with a capital cost of US\$68 million and a life of 25 years.

The running cost elements include:

Manning, including victualling US\$ 892,000

Lubes and stores US\$ 386,000

Spares, R & M US\$ 263,000

Dry docking (annualized cost) US\$ 688,000

Insurance US\$ 582,000

Administration US\$ 110,000

Miscellaneous US\$ 65,000

Running costs per annum = US\$ 2,986,000

Capital costs\* per annum = US\$ 4,825,000

Total operating costs per annum = US\$ 7,811,000

\* Annual capital costs calculated on a 5 percent rate of return over 25 years on an initial cost of US\$68 million.

### Fuel Adjustment Calculations

These figures calculate the effect on fuel consumption of carrying extra cargo as a result of a reduction of 0.5 meters in under keel clearance and based on a cost of US\$155 per ton of fuel.

Original payload of Very Large Crude Carrier (VLCC)	=	246,500 tons
Daily fuel consumption	=	97 tons
Reduced under keel clearance allows pay load of 263,000 tons		
and the daily fuel consumption	=	98 tons
i.e. the vessel uses 1 extra ton of fuel for every additional 16,500 tons of payload.		
Daily fuel consumption in ballast	=	82 tons

Assuming the longest voyage (Gulf-Yokohama) would take 21 days each way plus 3 days in port, then the round trip would take 45 days and the vessel could make 8 round trips per annum. In 2002 we have estimated that there were 1000 VLCC laden transits of the Straits. If each VLCC can now carry an additional 16,500 tons of cargo this implies that, *ceteris paribus*, only 938 laden transits will be required to transport the same volume of oil.

1000 transits ÷ 8 round trips	=	125 ships
938 transits ÷ 8 round trips	=	117 ships

Assuming 350 working days each year, of which 24 are spent in port leaves 326 days at sea, half of which will be laden and half in ballast.

Fuel consumption (laden)	=	98 tons/day
Fuel consumption (ballast)	=	82 tons/day

The fuel saved when sailing loaded using fewer ships and allowing for the payload penalty is given by:

Number of ships x days at sea x fuel consumption		
i.e. (125 x 163 x 97) – (117 x 163 x 98)	=	107,417 tons
The total savings (loaded)	=	107,417 tons x US\$155
	=	US\$16,649,635

There are also fuel savings from making fewer ballast voyages:

8 x 163 x 82	=	106,928 tons @ US\$155 per ton
	=	US\$16,573,840

Hence, the total fuel savings are US\$16,649,635 + US\$16,573,840 = US\$33,223,475

**Annex 10: Safeguard Policy Issues**  
**Marine Electronic Highway Demonstration Project**

**Projects on International Waterways**

Although the Project triggers [OP/BP/GP 7.50](#), Projects on International Waterways, the requirement of notification of other riparians does not arise. This is because the three littoral states of the Strait of Malacca, namely Republic of Indonesia, Malaysia and Republic of Singapore, are participating in the implementation of the Project, and are indeed the beneficiaries of the Project. The three states have signed a *Memorandum of Understanding* regarding their participation.

**Natural Habitats**

The Project was further carefully assessed for possible implications related to [OP/BP 4.04](#), Natural Habitats, and it was concluded that the Project does not trigger it this safeguard.

**Institutional Capacity for application of Safeguard Policies.**

All institutions with Project implementation responsibilities have been already involved in the implementation of World Bank projects and have the institutional capacity to apply the World Bank's Safeguard's Policies, including for screening and mitigation of possible negative environmental and/or social impacts. The implementing agencies will continue to assess the potential for any such possible impacts throughout Project implementation.

**Annex 11: Project Preparation and Supervision**  
**Marine Electronic Highway Demonstration Project**

	<b>Planned</b>	<b>Actual</b>
Project Concept Note review	October, 2002	June 23, 2003
Appraisal	March, 2003	January 4, 2006
Negotiations	March, 2003	February 10, 2006 with IMO March 14, 2006 with Indonesia
Board approval	May 30, 2006	
Planned date of effectiveness	July 1, 2006	
Planned date of mid-term review		
Planned closing date	June 30, 2011	

Key institutions responsible for preparation of the Project:

The International Maritime Organization and the Republic of Indonesia, Malaysia and Republic of Singapore.

World Bank staff and consultants who worked on the Project included:

<b>Name</b>	<b>Title</b>	<b>Unit</b>
Marc Juhel	Original Task Manager	TUDTR
Robin Carruthers	Second Task Manager and Economist	TUDTR
Hatim Hajj	Third Task Manager until February 2006	EASTR
Sally Burningham	Task Team Leader from March 2006	EASTR
Robin Broadfield	Regional Coordinator, GEF	EASEN
Milen Dyoulgerov	Consultant	ENV
Guoy Tong Kiat	Maritime Specialist, Consultant	
Firman Dharmawan	Procurement Specialist	EACIF
Imad Saleh	Procurement Specialist	EACIF
Richard Goss	Maritime Economist, Consultant	
Novira Asra	Financial Management Specialist	EACIF
Karin Nordlander	Legal Advisor	LEGEA
Anthony Toft	Chief Counsel	LEGEA
Sri Oktorini	Team Assistant	EACIF

Bank funds expended to date on Project preparation:

- |    |                           |  |
|----|---------------------------|--|
| 1. | Bank resources:           | US\$364,763 as of end April, 2006  |
| 2. | Trust funds: GEF Block B: | US\$560,826.52 (originally US\$574,210 was signed with US\$13,383.48 subsequently cancelled) |
|    | Total:                    | US\$925,589  |

Estimated Approval and Supervision costs:

- |    |                                    |   |
|----|------------------------------------|---|
| 1. | Remaining costs to approval:       | US\$13,000                                      |
| 2. | Estimated annual supervision cost: | US\$60,000 from the Global Environment Facility |

**Annex 12: Documents in the Project File**  
**Marine Electronic Highway Demonstration Project**

**General Documents**

Memorandum of Understanding	September 2005
Memorandum on Arrangements	September 2005
Project Implementation Plan	November 2005
Global Environmental Facility Project Brief	June 2003
Regional Action Plan, for Phase I MEH	January 2002
Present Status of Development of the MEH	May 2003
Report of Proceedings of the:	
First Project Steering Committee Meeting	March 2001
Second Project Steering Committee Meeting	May 2002
Third Project Steering Committee Meeting	October 2003
Fourth Project Steering Committee Meeting	December 2003

**Economic/ Feasibility Studies**

Feasibility Study, International Finance Corporation	1999
Cost Benefit Report for MEH, Cardiff University	June 2004
An Economic Approach to Maritime Legal Liability Benefit – Cost Analysis of Tourism Development and Sustainability in the Malacca Straits, GEF/UNDP/IMO	January 2004
	June 1998

**Environmental Studies/ Documents**

Oil Spill Modeling in East Asia Region, UNDP/ KORDI	1997
Malacca Straits Environmental Profile, GEF/UNDP/IMO	1997
Marine Pollution Management in the Malacca/ Singapore Straits : Lessons Learned, GEF/UNDP/IMO	March 1998
Natural Resource Damage Assessment and the Malacca Straits, GEF/UNDP/IMO	March 1999
Sustainable Financing for Ship-based Pollution in the Malacca Straits, GEF/UNDP/IMO	March 1999
Marine Pollution Prevention and Management in the East Asia Seas: A Benefit –Cost Framework, GEF/UNDP/IMO	March 1999
Regional Consultative Workshop on the Recovery of Oil Spill Clean-Up Costs and Pollution Damage Claims, GEF/UNDP/IMO	September 1999
Malacca Straits: Refined Risk Assessment, GEF/UNDP/IMO	1999
Challenges and Opportunities in Managing Pollution in the East Asia Seas, GEF/UNDP/IMO	March 1999
Proceedings of the Senior Experts Dialogue on Coastal and Marine Policy, PEMSEA	July 2001

Environmental Strategy for the Seas of East Asia, PEMSEA	August 2001
Regional consultative Workshop on Strengthening Recovery of Ship Pollution Clean-up Costs and damage Claims, PEMSEA, Singapore	September 2001

**Procurement and Financial Management documents**

Consulting Services for Economic Analysis	June 2004
Technical Specification of the Marine Electronic Highway System in the Straits of Malacca and Singapore	March 200
Procurement Plan	June 2005
Procurement Capacity Assessment	June 2004
Financial Management Assessment	June 2004

**Annex 13: Statement of Loans and Credits**  
**Marine Electronic Highway Demonstration Project**

ID	FY	Purpose	Original Amount in US\$ Millions						Difference between expected and actual disbursements	
			IBRD	IDA	SF	GEF	Cancel.	Undisb.	Orig.	Frm. Rev'd
P097535	2006	Community Recovery Through the KDP	0.00	0.00	64.70	0.00	0.00	51.20	0.00	0.00
P077175	2006	ID-Domestic Gas Market Development	80.00	0.00	0.00	0.00	0.00	80.00	0.00	0.00
P071296	2005	ID-USDRP	45.00	0.00	0.00	0.00	0.00	45.00	0.29	0.00
P076174	2005	ID-Initiatives for Local Govern. Reform	14.50	15.00	0.00	0.00	0.00	28.65	0.00	0.00
P078070	2005	Support for Poor and Disadvantaged Areas	69.00	35.00	0.00	0.00	0.00	102.12	0.00	0.00
P084583	2005	ID-UPP3	67.30	71.40	0.00	0.00	0.00	134.27	-0.34	0.00
P085133	2005	Govt Finl Mgt & Revenue Admin Project	55.00	5.00	0.00	0.00	0.00	56.31	0.64	0.00
P085374	2005	ID-Higher Education	50.00	30.00	0.00	0.00	0.00	78.29	0.00	0.00
P092019	2005	Kecamatan Development Project 3B	80.00	80.00	0.00	0.00	0.00	153.68	52.11	0.00
P095883	2005	ID Reconstruction of Aceh Land Admin	0.00	0.00	25.00	0.00	0.00	25.50	0.00	0.00
P074290	2004	ID-Eastern Indonesia Regional Transport 2	200.00	0.00	0.00	0.00	1.00	173.00	29.67	0.00
P071318	2004	ID - Coral Reef Rehab and Management II	0.00	0.00	0.00	7.50	0.00	7.02	0.43	0.00
P071316	2004	ID - Coral Reef Rehab and Mgmt Prog II	33.20	23.00	0.00	0.00	0.17	51.00	0.36	0.00
P064728	2004	ID-Land Management and Policy Develop.	32.80	32.80	0.00	0.00	0.16	59.38	6.46	0.00
P059931	2003	ID-Water Resources & Irr.Sector Mgt Prog	45.00	25.00	0.00	0.00	0.00	69.95	33.16	0.00
P063913	2003	ID-Java-Bali Pwr Sector & Strength	141.00	0.00	0.00	0.00	0.00	136.84	88.09	0.00
P079156	2003	ID Third Kecamatan Development Project	204.30	45.50	0.00	0.00	0.00	74.20	33.78	0.00
P076271	2003	ID-PPITA	17.10	0.00	0.00	0.00	0.00	13.14	10.23	0.00
P073772	2003	ID-Health Workforce & Services (PHP 3)	31.10	74.50	0.00	0.00	0.00	97.00	42.12	0.00
P072852	2002	ID-UPP2	29.50	70.50	0.00	0.00	0.00	77.15	37.33	0.00
P073970	2002	ID-GLOBAL DEV LEARNING (LIL)	2.66	0.00	0.00	0.00	0.00	1.68	1.68	0.00
P040578	2002	ID-Eastern Indonesia Regional Transport	200.00	0.00	0.00	0.00	0.00	41.30	39.64	0.00
P049539	2001	ID-Provincial Health II	63.20	40.00	0.00	0.00	0.00	80.23	67.81	0.00
P040528	2001	ID-W. JAVA ENVMT MGMT	11.70	5.75	0.00	0.00	0.00	7.68	6.81	1.72
P073025	2001	ID-SECOND KECAMATAN DEVELOPMENT PROJECT	208.90	111.30	0.00	0.00	0.00	61.60	46.97	0.00
P068051	2001	ID-GEF-W. JAVA ENVT MGMT	0.00	0.00	0.00	2.54	0.00	2.05	10.00	2.12
P068949	2001	ID-LIBRARY DEVELOPMENT PROJECT – LIL	0.00	4.15	0.00	0.00	0.00	0.56	0.00	0.00
P059477	2000	ID-WSSLIC II	0.00	77.40	0.00	0.00	0.00	43.65	34.00	0.00
P049545	2000	ID-PROVINCIAL HEALTH I	0.00	38.00	0.00	0.00	0.00	18.63	16.24	4.38
P040196	1999	ID-SUMATRA BASIC EDUCATION	54.50	20.10	0.00	0.00	0.00	0.35	0.99	0.00
P041895	1999	ID-SULAWESI BASIC EDUC.	47.90	15.93	0.00	0.00	0.00	11.09	11.85	0.00
P036049	1999	ID-EARLY CHILD DEVELOPMENT	21.50	0.00	0.00	0.00	10.65	1.33	11.99	11.99
P040061	1998	ID - BENGKULU REGIONAL DEVELOPMENT	20.50	0.00	0.00	0.00	5.00	4.63	9.63	4.63
P003993	1998	ID-SUMATRA REG'L RDS	234.00	0.00	0.00	0.00	50.00	7.08	57.08	1.40
Total:			2,059.66	820.33	89.70	10.04	66.98	1,795.56	649.02	26.24

**STATEMENT OF INTERNATIONAL FINANCE CORPORATION'S**  
**Held and Disbursed Portfolio**  
**In Millions of US Dollars**

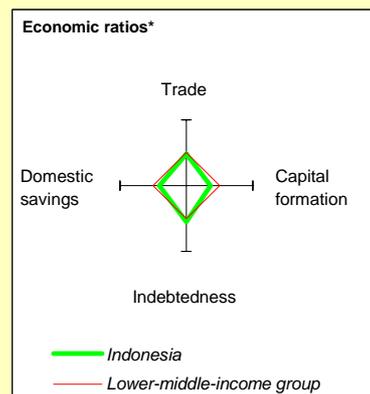
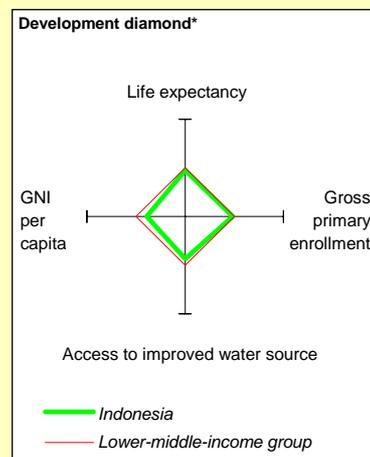
FY Approval	Company	Committed				Disbursed			
		Loan	Equity	Quasi	Partic.	Loan	Equity	Quasi	Partic.
2004	BonaVista School	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00
2003	Buana Bank	0.00	12.16	0.00	0.00	0.00	12.16	0.00	0.00
2006	Buana Bank	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1999	ITCF	40.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	LYON-MLF-Ibis	2.01	0.00	0.00	2.01	2.01	0.00	0.00	2.01
2004	Medan NP School	1.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2002	P.T. Gawi	11.50	0.00	0.00	4.07	5.35	0.00	0.00	4.07
1989	PT Agro Muko	0.00	2.20	0.00	0.00	0.00	2.20	0.00	0.00
1997	PT Alumindo	4.78	0.00	0.00	0.00	4.78	0.00	0.00	0.00
1989	PT Astra	0.00	0.20	0.00	0.00	0.00	0.20	0.00	0.00
1994	PT Astra	0.00	0.19	0.00	0.00	0.00	0.19	0.00	0.00
2003	PT Astra	0.00	0.12	0.00	0.00	0.00	0.12	0.00	0.00
	PT Astra Otopart	0.00	0.70	0.00	0.00	0.00	0.70	0.00	0.00
2005	PT Astra Otopart	24.00	0.00	0.00	0.00	24.00	0.00	0.00	0.00
2005	PT Austindo N...	15.06	0.00	0.00	0.00	1.96	0.00	0.00	0.00
2000	PT Bank NISP	0.00	2.85	2.86	0.00	0.00	2.85	2.83	0.00
2002	PT Bank NISP	0.00	2.04	0.00	0.00	0.00	2.04	0.00	0.00
2004	PT Bank NISP	35.00	0.00	0.00	0.00	35.00	0.00	0.00	0.00
1997	PT Berlian	0.00	3.35	0.00	0.00	0.00	0.00	0.00	0.00
1993	PT Bina Danatama	0.07	0.00	0.00	0.00	0.07	0.00	0.00	0.00
1996	PT Bina Danatama	0.00	0.00	3.62	6.73	0.00	0.00	3.62	6.73
2004	PT Ecogreen	30.00	0.00	0.00	0.00	30.00	0.00	0.00	0.00
2005	PT Ecogreen	25.00	0.00	0.00	0.00	15.00	0.00	0.00	0.00
	PT Grahawita	0.00	0.00	5.00	0.00	0.00	0.00	5.00	0.00
1991	PT Indo-Rama	0.00	3.82	0.00	0.00	0.00	3.82	0.00	0.00
1995	PT Indo-Rama	0.00	1.57	0.00	0.00	0.00	1.57	0.00	0.00
1999	PT Indo-Rama	0.00	0.81	0.00	0.00	0.00	0.81	0.00	0.00
2001	PT Indo-Rama	20.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00
2003	PT Indo-Rama	5.00	0.00	0.00	0.00	4.88	0.00	0.00	0.00
2004	PT Indo-Rama	48.00	0.00	0.00	0.00	14.00	0.00	0.00	0.00
1992	PT KIA Keramik	0.23	0.00	0.00	2.00	0.23	0.00	0.00	2.00
1996	PT KIA Keramik	1.65	0.00	0.00	53.49	1.65	0.00	0.00	53.49
1995	PT KIA Serpih	4.50	0.00	0.00	49.50	4.50	0.00	0.00	49.50
1997	PT Kalimantan	11.25	0.00	0.00	0.00	11.25	0.00	0.00	0.00
	PT Makro	0.00	2.61	0.00	0.00	0.00	2.61	0.00	0.00
2000	PT Makro	0.00	1.25	0.00	0.00	0.00	0.79	0.00	0.00
1998	PT Megaplast	4.38	2.50	0.00	0.00	4.38	2.50	0.00	0.00
1993	PT Nusantara	0.00	0.00	10.16	7.90	0.00	0.00	10.16	7.90
2004	PT Prakars (PAS)	35.00	0.00	0.00	9.02	35.00	0.00	0.00	9.02
1997	PT Sayap	2.50	0.00	0.00	0.00	2.50	0.00	0.00	0.00
2001	PT Sigma	0.00	1.09	0.00	0.00	0.00	1.09	0.00	0.00
1995	PT Viscose	9.38	0.00	0.00	2.92	9.38	0.00	0.00	2.92
2004	PT Viscose	9.50	0.00	0.00	0.00	5.00	0.00	0.00	0.00

FY Approval	Company	Committed				Disbursed			
		Loan	Equity	Quasi	Partic.	Loan	Equity	Quasi	Partic.
1997	PT Wings	2.17	0.00	0.00	0.00	2.17	0.00	0.00	0.00
2003	SMM	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2001	Sunson	11.62	0.00	0.00	7.35	11.62	0.00	0.00	7.35
2005	WOM	0.00	20.00	0.00	0.00	0.00	19.93	0.00	0.00
2004	Wilmar	20.00	0.00	0.00	0.00	20.00	0.00	0.00	0.00
Total portfolio:		383.35	57.46	21.64	144.99	246.06	53.58	21.61	144.99

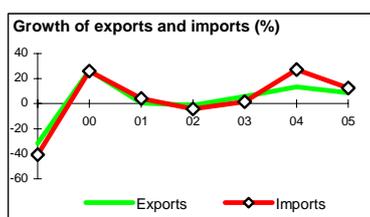
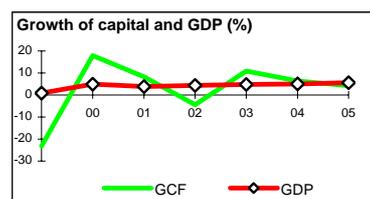
## Annex 14: Country at a Glance

### Marine Electronic Highway Demonstration Project

	Indonesia	East Asia & Pacific	Lower-middle-income	
<b>POVERTY and SOCIAL</b>				
<b>2005</b>				
Population, mid-year (millions)	221.3	1,870	2,430	
GNI per capita (Atlas method, US\$)	1,240	1,280	1,580	
GNI (Atlas method, US\$ billions)	273.9	2,389	3,847	
<b>Average annual growth, 1999-05</b>				
Population (%)	1.4	0.9	1.0	
Labor force (%)	2.7	1.1	0.7	
<b>Most recent estimate (latest year available, 1999-05)</b>				
Poverty (% of population below national poverty line)	17	..	..	
Urban population (% of total population)	46	41	49	
Life expectancy at birth (years)	66	70	70	
Infant mortality (per 1,000 live births)	31	32	33	
Child malnutrition (% of children under 5)	27	15	11	
Access to an improved water source (% of population)	70	78	81	
Literacy (% of population age 15+)	91	90	90	
Gross primary enrollment (% of school-age population)	111	113	114	
Male	112	113	115	
Female	110	112	113	
<b>KEY ECONOMIC RATIOS and LONG-TERM TRENDS</b>				
	<b>1985</b>	<b>1995</b>	<b>2004</b>	<b>2005</b>
GDP (US\$ billions)	87.3	202.1	254.3	287.2
Gross capital formation/GDP	28.0	31.9	23.2	22.2
Exports of goods and services/GDP	22.2	26.3	32.1	33.5
Gross domestic savings/GDP	29.7	30.6	27.9	26.6
Gross national savings/GDP	49.2	56.3	24.9	23.4
Current account balance/GDP	-2.2	-3.2	0.6	0.3
Interest payments/GDP	2.7	3.1	4.6	1.7
Total debt/GDP	42.0	61.5	53.9	46.5
Total debt service/exports	28.8	29.9	-25.7	-27.0
Present value of debt/GDP	..	..	..	..
Present value of debt/exports	..	..	..	..
	<b>1985-95</b>	<b>1995-05</b>	<b>2004</b>	<b>2005</b>
<i>(average annual growth)</i>				
GDP	7.7	2.2	5.1	5.6
GDP per capita	5.9	0.8	3.6	3.8
Exports of goods and services	9.3	2.4	13.5	8.6



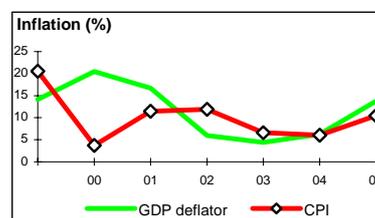
	1985	1995	2004	2005
<b>STRUCTURE of the ECONOMY</b>				
<i>(% of GDP)</i>				
Agriculture	23.2	17.1	15.6	13.4
Industry	35.8	41.8	44.3	45.8
Manufacturing	16.0	24.1	28.7	28.1
Services	40.9	41.1	40.1	40.8
Household final consumption expenditure	59.1	61.6	63.7	65.2
General gov't final consumption expenditure	11.2	7.8	8.4	8.2
Imports of goods and services	20.4	27.6	27.4	29.2
	<b>1985-95</b>	<b>1995-05</b>	<b>2004</b>	<b>2005</b>
<i>(average annual growth)</i>				
Agriculture	3.4	2.4	4.1	0.6
Industry	9.7	2.1	3.9	4.2
Manufacturing	11.2	3.3	6.2	4.8
Services	7.9	2.2	6.8	9.1
Household final consumption expenditure	6.5	3.3	9.4	7.4
General gov't final consumption expenditure	4.6	3.6	4.0	8.1
Gross capital formation	11.0	-3.4	6.4	4.2
Imports of goods and services	8.5	0.0	27.1	12.3



Note: 2005 data are preliminary estimates.

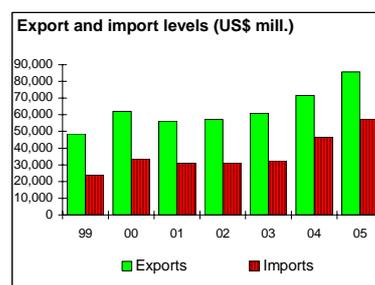
## PRICES and GOVERNMENT FINANCE

	1985	1995	2004	2005
<b>Domestic prices</b>				
(% change)				
Consumer prices	4.8	9.4	6.1	10.5
Implicit GDP deflator	4.3	9.7	6.3	13.7
<b>Government finance</b>				
(% of GDP, includes current grants)				
Current revenue	19.8	15.6	17.6	18.2
Current budget balance	-2.3	7.8	7.4	7.6
Overall surplus/deficit	-1.0	4.1	-1.0	-0.5



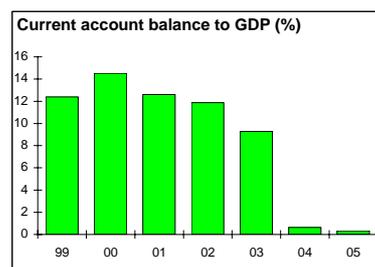
## TRADE

	1985	1995	2004	2005
(US\$ millions)				
Total exports (fob)	18,527	45,418	71,585	85,625
Fuel	..	10,465	15,803	19,155
Rubber	..	2,916	1,144	1,468
Manufactures	..	18,312	22,063	22,343
Total imports (cif)	10,259	40,629	46,525	57,600
Food	..	3,022	3,786	3,888
Fuel and energy	..	3,007	11,797	17,429
Capital goods	..	16,290	12,175	13,949
Export price index (2000=100)	..	24	107	124
Import price index (2000=100)	..	26	114	130
Terms of trade (2000=100)	..	95	94	95



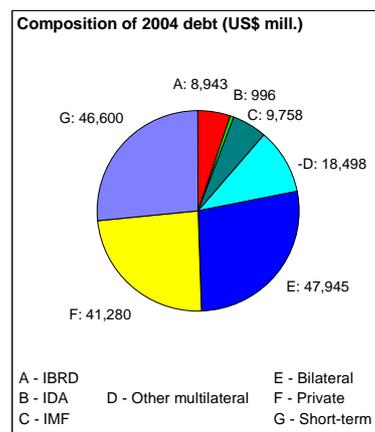
## BALANCE of PAYMENTS

	1985	1995	2004	2005
(US\$ millions)				
Exports of goods and services	19,371	52,923	89,783	89,783
Imports of goods and services	17,840	54,461	79,116	79,116
Resource balance	3,062	-3,076	10,667	10,667
Net income	-3,542	-11,748	-10,917	-10,768
Net current transfers	88	981	1,138	1,189
Current account balance	-1,923	-6,431	1,564	930
Financing items (net)	2,433	9,578	-1,255	-1,315
Changes in net reserves	-510	-3,147	-309	385
<b>Memo:</b>				
Reserves including gold (US\$ millions)	5,880	14,787	36,320	34,729
Conversion rate (DEC, local/US\$)	1,110.6	2,248.6	8,938.9	9,504.0



## EXTERNAL DEBT and RESOURCE FLOWS

	1985	1995	2004	2005
(US\$ millions)				
Total debt outstanding and disbursed	36,715	124,398	137,024	133,482
IBRD	3,590	12,503	8,943	8,131
IDA	844	756	996	1,000
Total debt service	5,823	16,416	-23,647	-24,855
IBRD	384	1,875	1,931	1,865
IDA	12	26	34	34
Composition of net resource flows				
Official grants	273	501	29	134
Official creditors	980	1,129	-2,927	-3,017
Private creditors	154	2,303	554	-400
Foreign direct investment (net inflows)	310	4,346	-3,408	-3,118
Portfolio equity (net inflows)	0	1,493	4,409	6,084
World Bank program				
Commitments	1,068	1,312	773	900
Disbursements	777	2,090	649	646
Principal repayments	133	975	1,389	1,417
Net flows	644	1,115	-740	-771
Interest payments	262	926	576	482
Net transfers	382	188	-1,316	-1,253



## **Annex 15: Incremental Cost Analysis**

### **Marine Electronic Highway Demonstration Project**

#### **The Project's Strategic Context**

1. The Straits of Malacca and Singapore are relatively shallow, hazardous to navigation, and characterized by narrow channels, irregular tides and shifting bottom topography. The Straits are also of global marine biodiversity significance, rich in the marine fauna and flora that characterize tropical estuarine environments. Abundant seagrass beds, mangroves, coral reefs and wetlands enrich the associated coastal marine environments, which are also stopover points for migratory birds on seasonal transition. Marine natural resource-related activities such as fishing and coastal tourism, are very important sources of income for the millions of people living in the coastal zone.
2. The Straits are also the preferred international route for the majority of ships en route between the Persian Gulf and the Far East, mainly because the two alternative routes (the Lombok-Makassar and Sunda Straits) add several days to the voyage. Recent enhancements in maritime safety infrastructures and regulatory mechanisms in the Straits have improved navigational safety, vessel traffic flow and the overall management of the Straits as a major international sea lane. However, the volume of international traffic passing through the Straits or calling at its ports is very heavy for such a confined and environmentally-sensitive waterway and is increasing steadily. In 2001, 146,265 vessels (>75 gross tons) called at the port of Singapore. Vessel arrivals from 1995 to 2001 increased by an average 6 percent per year for the Port of Singapore and 11 percent for Port Klang in Malaysia. There is also substantial volume of cross-Straits traffic between the three littoral States for trade and fishing. Notwithstanding the current navigation system, the risk of ship collisions and groundings and of consequent environmental and economic damage is high.
3. Ship-based sources contribute 20 percent of the marine pollution in the Straits and have acute impacts on it. The major pollutants from ships are oil, chemicals, liquefied gases, sewage, garbage, bilge water, ballast water and antifouling paints. The biggest concern is a catastrophic oil spill due to collision and/or grounding of a very large tanker, thousands of which pass through the Straits each year. An oil spill can cover a vast area of the sea's surface, as well as neighbouring beaches, and its damage can be considerable. The cost of cleaning-up an oil spill is very high and its environmental impact on living resources, particularly sea birds and near-shore sessile organisms, is significantly detrimental.
4. Unfortunately, recent incremental improvements to existing navigational aids and facilities in the Straits of Malacca and Singapore have not reduced the incidence of ship collisions and grounding or of chemical and oil spills. Although risk assessment of tankers in the Straits based on tanker accidents in the period from 1982 to 1993 showed a relative constant risk at 0.029 percent ( $\pm 0.03=95$  percent CL) [Malacca Straits: refined risk assessment, GEF/UNDP/IMO Regional Programme, 1999], a steady number of serious vessel accidents have occurred in recent years, such as the 'Natuna Sea' (October 2000) and 'Singapura Timur' (May 2001). Total compensation claims for the 'Natuna Sea' from the three littoral States were over

US\$127 million, however only 8.48 percent was paid due to unsubstantiated and disallowed claims, especially on environmental and fishery-related damage.

5. Although the three littoral States of Republic of Indonesia, Malaysia and Republic of Singapore have relatively good oil spill response capabilities, including oil spill contingency plans and response facilities and a cooperative response agreement, several recent serious shipping accidents have highlighted the need for quicker and better targeted deployment of spill response equipment and manpower and more efficient institutional arrangements. Immediate access to information on the resources at risk, on spill location, and on the locations of stockpiled response equipment would also raise the effectiveness and efficiency of an oil spill response.

### **The Baseline Scenario**

6. The littoral States of Republic of Indonesia, Malaysia and Republic of Singapore have demonstrated and continue to demonstrate a strong commitment to navigational safety and environmental management of the Straits. Each country has ratified the 1982 United Nations Convention of the Law of the Sea (UNCLOS) and International Convention for the Prevention of Marine Pollution from Ships (MARPOL 73/78), in addition to other IMO Conventions dealing with navigational safety and pollution prevention and control. The three countries are also signatories to the Tokyo Memorandum of Understanding on Port State Control, involving inspection of vessels for validation of International Oil Pollution Prevention Certificates.

7. Singapore initiated a Vessel Traffic Information Service in 1990. This comprehensive radar and computer-based vessel traffic system, which covers the Singapore Strait, can show the positions of up to 1,000 vessels at a time. In 1998, Malaysia commissioned a radar and vessel traffic monitoring system at Port Klang, covering the Malacca Straits. In that year also, a Differential Global Positioning System (DGPS) station was installed by Singapore and Singapore released Electronic Navigation Charts for the Singapore Strait, which are fully compliant with international standards. A DGPS station was recently installed by Malaysia in Lumut Island north of One Fathom Bank is currently being tested.

8. A Mandatory Ship Reporting System, STRAITREP, came into force on 1 December 1998, which requires designated vessels to report to the marine authorities of the littoral States when transiting the Malacca and Singapore Straits via Very High Frequency voice radio communication. Designated vessels entering the operational area report their name, call sign, IMO identification number (if available), position, any hazardous cargo and any deficiencies that could affect navigation. STRAITREP is divided into nine sectors, each with assigned Very High Frequency channel. The operators provide information to each participating vessel about specific and critical situations and traffic movements that could potentially cause problems, as well as other information relevant to navigational safety.

9. Under the Baseline (Business-as-Usual) Scenario, the littoral states will continue to maintain and upgrade existing navigation systems and will establish a few new AIS and DPGS reference stations to increase area coverage of maritime communications in the Straits. They will also maintain their existing oil spill response capacity and facilities. They will continue to monitor the environmental condition of the Straits on an ad hoc basis, but will lack

comprehensive information on the environmental condition of the Straits and detailed information on whether individual ships are leaking oil or dumping bilge water and so will not be able to effectively deter such behaviour. And will have no mechanism for sharing shipping or environmental information or agreeing joint action on it.

10. Ships passing through the Straits will continue to navigate from paper charts that are invariably out-of-date. They will utilize the available AIS and DPGS facilities to monitor their positions, but, due to the relatively high risk of collisions and groundings, some will be reluctant to pass through the Straits at times of poor visibility, in bad weather or at low tide and will be forced to load conservatively and to anchor and wait for more favourable navigational conditions during bad weather.

11. In sum, with the increasing volume of maritime traffic and port development in the Straits, as well as the increasing mix of other uses (e.g., marine recreation, fisheries), the capacity of the Straits to handle such shipping growth and diverse uses safely and efficiently will be severely taxed. From the maritime safety standpoint, continued growth in shipping movements will lead to more congestion and will require more intensive monitoring, especially along critical areas of the Traffic Separation Scheme. The effects of this congestion will be exacerbated by the Straits tricky weather conditions and its strong tidal regime. This combination of factors will cause significant ship delays or diversions, more conservative ship loading and a higher risk of collision and grounding. The environmental consequences of the aforementioned outcomes will be an increasing number and magnitude of oil spills and more bilge water discharges and chemical spills from ships.

### **The GEF Alternative Scenario**

12. Under the GEF Alternative Scenario, Indonesia, Malaysia and Singapore will: (a) establish a Marine Electronic Highway (MEH) demonstration system, covering a 100 kilometer section of the Straits of Malacca and Singapore from One Fathom Bank to the Horsburgh Lighthouse, which roughly corresponds to the Traffic Separation Scheme, and in which shipping is heavily concentrated and some of the MEH technology is already in operation; (b) assess its domestic and global/regional benefits and its financial viability, and, if the benefits of a full scale MEH for the entire Straits of Malacca and Singapore justify its cost and if it is financially viable, (c) prepare a Phase 2 project to extend the demonstration system to entire Straits and facilitate its replication on the entire Persian Gulf to the Far East shipping route, and (d) initiate marine environment information sharing and management collaboration between the marine and environmental institutions in the littoral states and between the littoral states.

13. The MEH demonstration system will be an integrated and comprehensive regional network of marine information technologies, comprising: (a) continuously updated and highly accurate Electronic Navigation Charts (ENCs) for the target section of the Straits; and (b) ship-based Electronic Chart Display and Information Systems (ECDIS) and ship Automatic Identification Systems (AIS) installed on and operated by a significant number of the larger oil tankers and container ships that regularly use the Straits. The system will be designed from the end-users' perspective and requirements and will make full use of new technologies, their applications and management. Other components will include the review of alternative

sustainable financing mechanisms, consistent with obligations associated with accession or ratification of relevant international conventions, protocols, agreements and treaties; legal, institutional and administrative arrangements; and political and public relations initiatives to enhance the utility and acceptability of the MEH system and its long-term sustainability.

14. The GEF Alternative Project will involve the following four key tasks/challenges:

1. Integration of existing marine information technologies and capacities within the three littoral States with the new and innovative MEH technologies to meet marine transport and environmental management needs of the three countries and the users of the Straits.
2. Institutional arrangements for installation and operation of the demonstration system, including agreement among participating parties on the administrative, legal, financial and operational aspects of a MEH managing organization, which will be responsible for implementing this first phase MEH system in the Straits.
3. Quantification of the socio-economic benefits to the governments, industry/private sector and the coastal communities of the MEH demonstration system and of a potential full-scale system covering the entire Straits and assessment of its financial feasibility.
4. If the conclusions of the socio-economic and feasibility analyses are both positive and the three littoral states decide to expand the MEH system to the entire Straits, establishment of the inter-agency and inter-governmental partnerships required to develop, finance, construct and operate the MEH as a potentially self-sustaining, revenue-generating enterprise.

#### **The GEF Alternative Project's Objective**

15. The project is the first, demonstration phase of a potential two-phase program to establish and achieve widespread use of a Marine Electronic Highway (MEH) system in the Straits of Malacca and Singapore. Its objective is to demonstrate, by establishing an MEH in the narrowest and most congested section of the Straits, that an MEH for the entire Straits is economically and environmentally justified and is financially viable and, by so doing, to catalyze the establishment of a MEH for the entire Straits and its widespread use by ships passing through the Straits, particularly large crude oil carriers and container ships which pose the greatest risk of causing major environmental and economic damage to the Strait's biological resources.

#### **The MEH Program's Global Environment and Development Goals**

16. The MEH program's local and global environmental goals (of which this project is the first phase) are to reduce marine pollution and strengthen marine environmental management in the Straits of Malacca and Singapore. Its economic/development objective is to reduce the cost of ship transport through the Straits by improving marine navigational safety and efficiency. If the MEH program shows that these goals can be achieved in a cost-effective and sustainable manner, it is expected that the program will serve as a global demonstration of the MEH system and thereby: (a) facilitate its extension to the entire shipping route from the Persian Gulf through

the Chinese Seas to the Yellow Sea and the Sea of Japan; and (b) trigger its replication world-wide.

### **Incremental Costs of the MEH Demonstration Project**

17. The Incremental Costs of the GEF Alternative Project total about US\$17.0 million. Of this, private sector ship owners and operators will fund about US\$6.0 million for the ship-based equipment required to utilize the MEH; Indonesia, Singapore and Malaysia will fund about US\$2.7 million of investment in upgraded shore facilities to supply the additional real-time information it requires; and the GEF is requested to fund the balance of US\$8.3 million, which will finance the system's detailed design and the initial start-up and operation of the MEH management organization.

### Incremental Cost Matrix

Component	Baseline	Alternative	Domestic Benefits	Global/Regional Benefits
<p>Integration of existing, standard marine navigation and environment systems in the Straits of Malacca and Singapore into a Marine Electronic Highway System.</p>	<p>Littoral States have established various navigational aids and measures, including mandatory STRAITREP, which are maintained and slowly upgraded to marginally improve safety of navigation, reduce ship environmental damage and improve monitoring of maritime traffic.</p>	<p>Major improvement in maritime traffic and environmental management through installation of an integrated, electronic MEH system, which would enable interactive tracking, guiding and monitoring of larger ships transiting, crossing or calling at ports along the congested and confined waters of the Straits.</p>	<p>Significantly improved safety margin for vessel operations.</p> <p>Increase in operational efficiencies of vessels.</p> <p>Reduced incidence and risk of collisions, possibly leading to lower insurance premiums.</p> <p>Lower oil spill response and clean-up costs.</p> <p>Improved quality and availability of marine environment information.</p> <p>Greater use of local port facilities and services.</p> <p>Reduce congestion and more efficient vessel traffic management, including cross-Straits traffic.</p>	<p>Less environment-related damage in the Straits of Malacca and Singapore due to improved navigational safety.</p> <p>Lower ship fuel consumption and greenhouse gas emissions.</p> <p>Accessibility and exchange of marine environmental information at any time at low cost facilitates better conservation.</p> <p>Enhanced monitoring and forecasting of oceanographic, meteorological and environmental conditions of the Straits, including biodiversity mitigates impact of shipping accidents.</p> <p>Better oil spill detection, prediction and more effective response results in less environmental damage from</p>

<b>Component</b>	<b>Baseline</b>	<b>Alternative</b>	<b>Domestic Benefits</b>	<b>Global/Regional Benefits</b>
				spills that do occur.  Improved compliance with marine environment conventions and standards
Production of electronic charts for the MEH system's 100 kilometer section of the Straits.	Small scale Electronic Navigation Charts from the Four Nations Joint Survey completed but not yet released or used. Little use will be made of them due to their modest quality and coverage.	Production of high resolution Electronic Navigation Charts for the Straits will enhance voyage planning and navigational safety as well as reducing the risk of groundings and collisions.	Same as above	Same as above
Marine information technology integration	Advances and widespread utility of Information and communication technology has resulted in various applications in the maritime sector including Internet connectivity and e-commerce.	Integration of national maritime safety and marine environment data under the multimodal MEH system enables rapid delivery of integrated information in real time, particularly useful for marine emergency response and maritime security.	Same as above	Same as above
Development of MEH operations and administrative mechanisms.	Littoral States have consistently carried out regional cooperation to address common concerns on maritime safety and marine environment protection.	Regional cooperation on the establishment and operation of the MEH system develops mechanisms on regional collaboration and sustainable financing and	Same as above	Same as above

Component	Baseline	Alternative	Domestic Benefits	Global/Regional Benefits
		institutional arrangements that include the private sector.		
Integration and enhancement of regional marine environment protection systems within the MEH framework	<p>Pollution preventive measures in the Straits are in place at the national and regional levels, which include navigational aids, oil spill contingency plans and response programmes as well as environmental monitoring.</p> <p>Environmental monitoring in the Straits is generally undertaken on an <i>ad hoc</i> basis, including collection of hydrographic and oceanographic data.</p> <p>Application of environmental data in the Straits is limited, particularly on transboundary issues, including pollution response, due technical and resources limitations.</p>	<p>Integrated and multimodal approach to pollution prevention, response and management in the Straits through the Marine Electronic Highway system will ensure effective, efficient and timely intervention of spill incidents.</p> <p>Through information and communication technology, continuous and real time environmental monitoring is achieved, ensuring reliable and accurate assessments and forecasts.</p> <p>Availability of sea-based monitoring devices for hydrographic and oceanographic parameters with telemetry capability significantly enhance monitoring programs and the use of environmental data</p>	<p>Reduced risk of shipping accidents (groundings and collisions) in ports and congested sea lanes and better port maneuvers.</p> <p>Increased cargo load due to better definition of under keel clearance with updated and precise bottom soundings.</p> <p>Reduced damage claims associated with oil spills.</p> <p>Reduce queuing time for vessels at entering the Traffic Separation Scheme or ports.</p> <p>Better usage of port facilities.</p> <p>Reduce red tape in data acquisition, delivery and access.</p>	<p>Improved emergency response (search and rescue, pollution response) reduces negative regional environmental impacts of ship accidents or pollution releases.</p> <p>Model of marine environmental information management and collaborative response for other sea areas in the world, especially along congested and busy waterways.</p>

<b>Component</b>	<b>Baseline</b>	<b>Alternative</b>	<b>Domestic Benefits</b>	<b>Global/Regional Benefits</b>
		for policy and management decisions.		
Evaluation of the economic, social and environmental benefits of the demonstration MEH	No action.	The user States, private sector partners and donors contribute to a participatory evaluation of the MEH Demonstration system as a precursor to its possible expansion to the entire Straits.	The evaluation takes full account of the cost/benefit assessments of the three participating governments and the MEH's private sector partners.	
Feasibility assessment and design of an Environment Fund for the Straits of Malacca and Singapore.	Few resources available for the environmental management of the Straits of Malacca and Singapore and no financial contribution from users of the Straits.	Establishment of a Revolving Fund and perhaps multi- and bilateral agreements and arrangements to address maritime safety and improve environmental management of the Straits.	Better management of the coastal and marine resources of the Straits on which many thousands of local people depend.	More effective conservation of the globally significant marine and coastal biological resources of the Straits of Malacca and Singapore.
Design of the Second Phase of the MEH System covering the entire Straits and promotion of its replication on the Gulf-Far East ship route and World-wide.	No action.	If economically and financially feasible and environmentally justified, development, financing and operation of a MEH system for the entire Straits and promotion of its replication elsewhere.	Enhanced vessel operating efficiency, higher navigational safety standards linked with integrated marine environment protection and sustainable development of the coastal and marine resources of the entire Straits.	The MEH Demonstration Project's global environment benefits are extended to the entire Straits of Malacca and Singapore, potentially into the East Asian Seas, Bay of Bengal and Indian Ocean, and possibly in other parts of the World.