EAST ASIA AND PACIFIC
4E-Marine Electronic Highway

GEF Project Brief

East Asia and Pacific Region
EASTR

Date:
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Country Manager/Director: N
Project ID: P068133
Focal Area: I - International Waters

Team Leader: Hatim M. Hajj
Sector(s): Ports, waterways and shipping (100%)
Theme(s): Regional integration (P), Pollution management and environmental health (P)

Project Financing Data

[ ] Loan [ ] Credit [X] Grant [ ] Guarantee [ ] Other:

For Loans/Credits/Others:
Amount (US$m):

Financing Plan (US$m): Source	Local	Foreign	Total
BORROWER/RECIPIENT	1.58	0.35	1.93
GLOBAL ENVIRONMENT FACILITY	2.16	5.84	8.00
FOREIGN PRIVATE COMMERCIAL SOURCES (UNIDENTIFIED)	0.00	5.52	5.52
Total:	3.74	11.71	15.45

Borrower/Recipient: GOVERNMENTS OF INDONESIA & MALAYSIA
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Estimated Disbursements (Bank FY/US$m):

FY	2004	2005	2006	2007	2008				
Annual	1.20	2.80	2.00	1.60	0.40				
Cumulative	1.20	4.00	6.00	7.60	8.00				

Project implementation period: 4/1/2004 to 3/31/2008
Expected effectiveness date: 09/01/2004 **Expected closing date:** 12/31/2008

A. Project Development Objective

1. Project development objective: (see Annex 1)

5. The project is the first (demonstration) phase of a potential two-phase program to eatablish a Marine Electronic Highway (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. The potential full-scale MEH program's development objectives are to increase the efficiency of marine transport through the Straits, reduce its negative environmental impacts, and strengthen the conservation and mangement of neighboring marine and coastal environments. The MEH would achieve these objectives by: (a) reducing the frequency of ship collisions in the Strait's congested sea lanes and ports; (b) making marine navigation in the Straits safer and therefore more often feasible in poor weather; (c) tracking and monitoring vessel operations, such as illegal bilge water releases, in the Straits, with benefits for the management and protection of marine and coastal resources; and (d) testing the feasibility of a MEH fund to co-finance the system and to support coastal and marine resource conservation and management in the Straits area. The program would thus 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.

2. Key performance indicators: (see Annex 1)

The key indicators for the demonstration project will be:
(a) full-time operation of a reliable, state-of-the-art MEH system covering the target 100 km section of the Straits of Malacca and Singapore; (b) use of the system by a significant proportion of the large crude oil tankers and container ships that pass through the Straits; (c) enhanced capacity of the maritime management staff of the three participating countries to jointly promote maritime safety and marine environment protection; (d) an initial assessment of the marine pollution prevention and ship operational benefits of the MEH demonstration system; (e) design of a proposed financing mechanism for the MEH system and for a regional Marine Environment Conservation Fund; and (f) a professional evaluation of the financial, economic and legal feasibility and potential environmental benefits of a full-scale MEH system covering the entire Straits of Malacca and Singapore.

The key indicators of the two-phase program (assuming the second phase is implemented) will be:

- the number of shipping accidents or incidents occuring yearly along the maritime lanes covered by the MEH;
- the percentage of ships plying the covered zone equipped with adequate onboard equipment to benefit from the MEH system;
- the reduction of marine insurance premiums for regional shipping lines sailing regularly through the MEH-covered area;
- once the MEH is established in its permanent setting, the revenues accruing into the Maritime Environment Management Fund.

B. Strategic Context

1. Sector-related Country Assistance Strategy (CAS) goal supported by the project: (see Annex 1)

Document number: Report No.21580-IND **Date of latest CAS discussion:** February 8, 2001

There is no CAS for Malaysia at this time, and the Bank does not operate in Singapore.

For Indonesia, the MEH project would contribute to the CAS objectives in two ways: (i) in helping secure a safe and cost-effective maritime transport environment to and from Indonesia's main seaports and external trade gateways, which will support economic growth objectives and private sector

development; and (ii) in helping improve natural resource management and environmental protection, in particular in marine ecosystems.

1a. Global Operational strategy/Program objective addressed by the project:

6. The proposed program will help overcome the barriers to the adoption of best-practice technology in marine navigation and pollution control, and thereby reduce the contamination of the international waters, which is one of the major objectives of the GEF's Operational Program 10 - the International Waters Contaminent-Based Operational Program. The proposed MEH program is a partnership between governments, the GEF and the private sector, and is therefore also consistent with one of the GEF's key strategic objectives, which is to promote public-private partnerships that benefit the global environment.

7. More effective action to reduce marine pollution is a GEF priority because 90% of world trade, in tonnage terms, is currently and will in the forseeable future be transported by ships, which are a significant threat to the marine environment. Economic development in many parts of the world, and especially in the dynamic Asia-Pacific region, will increase the demand for maritime transport. This, coupled with burgeoning coastal populations that depend heavily on marine ecosystems, makes it essential to reduce marine pollution from ship-based sources by, *inter alia,* reducing ship collisions, oil spills and illegal bilge water discharges. One of the most promising means of achieving these objectives is through rapid and widespread use of state-of-the-art navigation systems and effective marine pollution monitoring and control technology. This proposed program is designed to accelerate the use of such technology in the Straits of Malacca and Singapore and elsewhere in the developing World.

8. GEF support for the program is further justified because the Straits of Malacca and Singapore is a zone of high marine biodiversity significance, rich in marine fauna and flora that is characteristic of tropical estuarine environments. The abundance of seagrass beds, mangrove swamps, coral reefs and wetlands enriches the associated coastal marine environments, which are also stopover points for migratory birds on seasonal transition. Natural resource-related activities such as fishing and coastal tourism have also boosted the regional economy. By catalysing the MEH program and better protecting these natural resources, the GEF can therefore help to generate local and regional sustainable development benefits also.

9. In summary, the proposed MEH program is consistent with the GEF's Operational Strategy and Operational Programs in the following respects:

1. It will develop and demonstrate an innovative system of maritime traffic management and pollution prevention that will reduce the accidental spills of oil and chemical substances that damage international waters.
2. It will develop and demonstrate innovative regional networking of information technology that will enhance monitoring and enforcement of MARPOL regulations.
3. It will strengthen the technical capabilities and the institutional and co-ordinating arrangements among the region's littoral States to collectively prevent, manage and respond to transboundary marine pollution.
4. It will establish a mechanism that facilitates co-operation between the public and private sectors.
5. It will conserve significant marine and coastal biodiversity and promote sustainable development.

2. Main sector issues and Government strategy:

10. Although the Straits of Malacca and Singapore are shallow, hazardous to navigation, and characterized by narrow channels, irregular tides and shifting bottom topography, they are 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 (Lombok-Makassar and Sunda Straits) add several days 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 already heavy for such a confined and environmentally-sensitive waterway and is increasing steadily. In 1997, approximately 104,000 vessels transited the Straits of Malacca and Singapore, and in 2001, 146,265 vessels (>75 GT) arrived at the port of Singapore. Vessel arrival statistics from 1995 to 2001 showed an annual average increase in arrivals of 5.96% for the Port of Singapore and 10.58% for Port Klang. There is also substantial volume of cross-Straits traffic between the three littoral States for trade and fishing. Notwithstanding the current navigation system, the threat of collision and grounding and of consequent environmental damage is significant and is rising, and the cost of serious accidents is very high, which justifies further action to reduce them.

11. Although the three littoral States of Indonesia, Malaysia and Singapore have oil spill response capabilities, such as oil spill contingency plans and response facilities, including a cooperative response agreement, a series of recent serious shipping accidents have highlighted the need for a better traffic management system to reduce their incidence. Another lesson learned from recent incidents is the need for quicker deployment of spill response equipment and manpower and more efficient institutional arrangements. In addition to the more rapid response, immediate access to information on the resources at risk, on spill location and on the locations of stockpiled response equipment can also contribute to the effectiveness and efficiency of an oil spill response operation. Better and more efficient communication is the key to achieving a successful response in the event of an oil spill, but an effective ship monitoring system is also important to prevent such incidents, as well as to serve as early warning.

12. 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% (± 0.03=95%CL) [Malacca Straits: refined risk assessment, GEF/UNDP/IMO Regional Programme, 1999], a steady number of serious vessel accidents still occurred in recent years. For example, several vessel groundings and collisions occured in the past two years, some resulting in spillage of oil, such as the 'Natuna Sea' (October 2000) and 'Singapora Timur' (May 2001). Total compensation claims for the 'Natuna Sea' from the 3 littoral States were US$127,003,226, but only 8.48% was paid due to unsubstantiated and disallowed claims, especially on environmental and fishery-related damages (Annex 2). Reliable information on the Strait's natural resources, particularly its economic value, is certainly important and urgently needed in order to better quantify the economic losses incurred in the event of a chemical or oil spill in the Straits.

13. 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), are seriously taxing the capacity of the Straits to handle such growth and diverse uses safely and efficiently. From the maritime safety standpoint, continued growth will lead to more congestion and will require intensive monitoring, especially along critical areas of the TSS. The effects of this congestion are exacerbated by weather-related conditions, including the tidal regime. This combination causes ship delays or diversions, more conservative loading and higher risk of collision, allision and grounding. The environmental consequences of the aforementioned situations are increased risk in the number and magnitude of oil spills, discharges of bilge waters and chemical spills from ships. These facts have motivated the littoral States to adopt an innovative and more effective approach to improving the management of maritime traffic and marine environment protection in the Straits, which is to establish a Marine Electronic Highway (MEH) system.

3. Sector issues to be addressed by the project and strategic choices:

Issue 1: Marine pollution.

14. Land-based activities, such as agriculture, manufacturing industry and human settlements, contribute about 70% of the total marine pollution load in the Straits. However, because of its dispersed sources, land-based pollution is very difficult and costly to control. While ship-based sources of pollution contribute only about 20% of the pollution load, they often has an acute environmental impact and can be traced to specific sources, which makes action on them feasible and relatively cost-effective. Reduction ship collisions and groundings also benefits the shipping industry, which makes action to achieve that result a commercial and environmental win-win option.

15. The major pollutants from ships are oil, chemicals and noxious liquid substances, liquefied gases, sewage, garbage, bilge water, ballast water and antifouling paints. The biggest concern is a catastrophic oil spill, following a collision or grounding of a VLCC or any vessel carrying large quantities of bunker oil. The damage caused by an oil spill can be considerable and cover a vast area. The clean-up cost is always high and a spill's environmental impact on the living resources, particularly sea birds and near shore sessile organisms, is highly detrimental. A MEH system can significantly reduce the risk of these marine pollution occurences.

Issue 2: Ship operating costs.

16. A Marine Electronic Highway system offers ship owners and operators the opportunity to: (a) operate more safely in confined waters during periods of reduced visability and thus reduce transit time lost due to bad weather; (b) reduce the risk of collision, and hence repair and damage control costs and perhaps even insurance premia; (c) eliminate the current practice of manually updating paper charts. In combination, these benefits can significantly reduce ship operating costs.

Issue 3: Sustainable financing the MEH and local marine environment management.

17. A further atttribute of the MEH system is that its significant commercial benefits make it potentially feasible for the littoral States to develop a voluntary sustainable financing mechanism both for the recurrent costs of the MEH and, potentially, for local marine environment management. The MEH program will test if it is feasiblethrough a public/private partnership, to establish a MEH Fund for the Straits of Malacca and Singapore. If it is feasible, part of the Fund's revenue will be used for the operation, administration and management of the MEH system including its maintenance and upgrading, and part of the revenue will be used to strengthen local marine environmental protection and management. This would supplement the scarce public resources currently available for coastal and marine management and conservation. A description of the proposed MEH Fund is in Annex 4.

18. The structure and capitalization strategy for the MEH fund will be based on socio-economic, market and financial surveys to be conducted under the MEH Demonstration Project and will be further refined in the course of its implementation. A multisectoral Working Group will formulate the MEH Fund, its structure, financial controls, management and administration, strategy for leveraging private sector contributions and financial modalities for cost recovery. A pilot MEH Fund is envisaged to be operational during the later period of the MEH Demonstration Project but the revenue that will be generated will form part of the funding for the implementation of the MEH Full-scale Development Project.

C. Project Description Summary

1. Project components (see Annex 2 for a detailed description and Annex 3 for a detailed cost breakdown):

The MEH Demonstration Project has 7 strategic components aimed at addressing the aforementioned issues:

Component 1 Establish the Marine Electronic Highway and demonstrate its technical functionalities on navigation safety and marine environment protection for the Straits of Malacca and Singapore;

Component 2 Facilitate the integration of marine environment systems and data flow and information exchange through the MEH system;

Component 3 Develop the operational and administrative mechanisms for the sustainable management of the MEH system;

Component 4 Evaluate the financial, social and economic benefits and legal issues of the MEH system;

Component 5 Promote awareness and participation of relevant stakeholders to support the MEH system;

Component 6 Strengthen national and regional capacity in maritime safety and marine environment protection for the sustainable management of the MEH system; and

Component 7 Implement transitional activities to develop the first phase MEH Full-scale Development Project and assess the feasibility of establishing the second phase MEH system extending to other sea areas in the East and West of the Straits.

The logical framework matrix in Annex 1 provides a summary of analysis on the outputs, methodology, verifiable indicators to measure impacts and the assumptions made to implement the MEH Demonstration Project.

Component	Indicative Costs (US$M)	% of Total	Bank financing (US$M)	% of Bank financing	GEF financing (US$M)	% of GEF financing
Component 1 - Establishment of MEH System	11.22	72.7	0.00	0.0	4.15	51.9
Component 2 - Integration of Marine Environment Protection System	0.60	3.9	0.00	0.0	0.58	7.3
Component 3 - Development of Operational and Administrative Mechanisms	0.72	4.7	0.00	0.0	0.62	7.8
Component 4 - Evaluation of Financial, Social and Economic Benefits and Legal Issues	0.17	1.1	0.00	0.0	0.13	1.6
Component 5 - Promoting Participation of Relevant Stakeholders	0.17	1.1	0.00	0.0	0.13	1.6
Component 6 - Capacity Building, Evaluation and Project Management	2.46	15.9	0.00	0.0	2.33	29.1
Component 7 - Implement Transition to Full-scale MEH Development and Feasibility of Second Phase	0.10	0.6	0.00	0.0	0.06	0.8
Total Project Costs	15.44	100.0	0.00	0.0	8.00	100.0
Total Financing Required	15.44	100.0	0.00	0.0	8.00	100.0

2. Key policy and institutional reforms supported by the project:

The establishment of a financially sustainable MEH system in the Straits after the implementation of the two stages of the MEH Project is envisaged to strengthen existing regional and international cooperation among the littoral States and user States on navigational safety (e.g., STRAITREP) and maritime security (e.g., piracy, terrorism, armed robbery at sea) of the Malacca Straits including oil and chemical pollution prevention and response (e.g., ASEAN OSPAR), but more specifically, the flow and exchange of information and timely intervention on maritime incidents.

3. Benefits and target population:

Potential beneficiaries of the MEH system apart from the three littoral States and the shipping sector are those engaged in marine environment protection. Appropriate activities of the project have been formulated (e.g., integration of EMPS into the MEH system, assessment of the MEH technical functionalities, environmental models development and applications) including the development of public private partnership scheme, to ensure their participation as well as share in the responsibility of contributing to the development of the full-scale MEH system in the Straits.

4. Institutional and implementation arrangements:

The Project Steering Committee (PSC) established during the PDF Block B Grant period will continue 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 Project. 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.

Four Technical Committees and two Working Groups will be established in the course of implementing the MEH Demonstration Project to evaluate various technical issues and outputs of the project for the purpose of refining the activities for the MEH Full-scale Development Project, which will cover the entire Straits. The Technical Committees and Working Groups will be composed of relevant stakeholders of the MEH 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 Project.

Monitoring and evaluation of project activities will include milestones for each major activity with a corresponding specific timeframe to complete. In addition, there will be annual reviews by the Project Steering Committee as well as bi-annual internal reviews of project implementation as well as the results and outputs. The findings of these reviews will be used to assess project progress and the need to modify approaches and resources. The key performance indicators as shown in Annex 5 will be used to gauge the outputs and impacts of the MEH Demonstration Project.

In addition, review and evaluation of the project activities will be undertaken by four Technical Committees (TC) to address relevant issues on the implementation of the project and will come under the guidance and direction of the Project Steering Committee (PSC). Two Working Groups (WG) will be established at some stage of the project life to evaluate the impacts of the demonstration project as well as the formulation of the proposal for the MEH Full-scale Development Project. The technical committees and working groups will be composed of representatives from relevant stakeholders as well as consultants hired under the project. The project will participate in the annual GEF Project Implementation Review (PIR).

A Project Management Office will be established in the region to administer and manage the project

onsite and will have a Project Manager and four experts. The staff will be working closely with the national agencies staff assigned to the MEH Data Centres and oversee/coordinate the works of the consultants as well as providing support to the PSC, TC and WG.

D. Project Rationale

1. Project 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 significantly less potential for reducing ship-related environmental damages and for improving navigational efficiency than the more advanced MEH system.

2. Major related projects financed by the Bank and/or other development agencies (completed, ongoing and planned).

Sector Issue	Project	Latest Supervision (PSR) Ratings (Bank-financed projects only)	
		Implementation Progress (IP)	Development Objective (DO)
Bank-financed			
Other development agencies			

IP/DO Ratings: HS (Highly Satisfactory), S (Satisfactory), U (Unsatisfactory), HU (Highly Unsatisfactory)

3. Lessons learned and reflected in proposed 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 navigational charts and the Electronic Chart Display and Information System (ECDIS). The core of the Canadian version of the MEH was the integration and interconnection of the ECDIS and the Automatic Identification System (AIS) with powerful shore-based databases to provide a basis for optimised shipping traffic management decisions. Since 1995, the ECDIS has been widely deployed in the Great Lakes and the St. Lawrence River corridor with considerable success, especially in navigating through treacherous waters even in heavy fog conditions. However, standards for electronic navigational charts and the unavailability of type approved ECDIS during this early period led to the use of nonconformal 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 EDCIS in 1999 and the wider adoption of the IHO S-57 (electronic chart standard) due to technical and financial constraints. Furthermore, central government support waned. Consequently, the MEH concept remains to be realized. Nevertheless, the pioneering efforts in Canada on digital navigation had led to the widespread adoption of electronic navigational charts and the ECDIS and subsequently, by the world shipping industry accelerating the commercial development of electronic maritime technology and the necessary international standards. Since 1999, there are several type-approved ECDIS in the market and many national hydrographic agencies have S-57 ENC production capability.

The utility of ECDIS and ENCs is now well accepted in the maritime industry, being able to increase the safety net of vessels and improve commercial performance (e.g., 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, for instance, the reduction of vessel accidents and online availability of marine information could lead to improve monitoring and response to marine environmental incidents, lower response and clean-up costs and better quantification of damages as well

as enhance management of the coastal and marine resources in the Straits.

4. Indications of borrower and recipient commitment and ownership:

Two national workshops, one regional workshop and three regional meetings were conducted during the PDF Block B Grant period with the participation of a number of stakeholders with a variety of interests. Aside from participants from the littoral States, observers from user States, the maritime sector, maritime technology and telecommunications groups attended these gatherings. Their participation and inputs have significantly contributed to the refinement of the MEH concept and the development of the project proposal in general.

Apart from the PDF Block B Grant meetings and workshops, consultations were also undertaken with the participating countries and the shipping sector regarding the implementation of the pilot demonstration project. Overall, there has been a positive response from shipping sector in terms of active participation in the project. The partnership with the International Association of Independent Tanker Owners (INTERTANKO) and the International Hydrographic Organization in this demonstration project attests to such a positive response.

Over the years, the littoral States have largely financed the establishment of safety facilities and mechanisms in the Straits in aid of international navigation as well as in oil spill response and clean-up during a number of spill incidents due to tanker collision and grounding in the Straits. In addition, the three countries have, and continue to show, a strong commitment to safety of navigational and environmental management of the Straits by ratifying various international conventions dealing with maritime safety and pollution prevention and control. Moreover, national and regional projects and programmes that address some of the maritime safety and marine environment issues are being implemented by the littoral States, especially Indonesia and Malaysia with support from donors and international agencies.

5. Value added of Bank and Global support in this project:

Bank and GEF support for the MEH Demonstration project will make it possible to establish the conditions under which the MEH system can be viable both technically and financially, then paving the way for further development along international sea lanes. From then on, Bank and GEF support, in cooperation with IMO, will facilitate the dissemination of knowledge and experience so as to spur the replication of the MEH system, in particular in regions where developing countries will need institutional support and capacity building to be able to play their part in establishing the system and to reap the expected benefits, both in terms of more economically efficient international transport and of more sustainable marine environment protection policy.

E. Summary Project Analysis (Detailed assessments are in the project file, see Annex 8)

1. Economic (see Annex 4):

● Cost benefit NPV=US$ million; ERR = % (see Annex 4)

○ Cost effectiveness

○ Incremental Cost

○ Other (specify)

The GEF will be asked to fund the incremental costs of removing the barriers to the development and adoption of a MEH for the Straits of Malacca and Singapore. These incremental costs will be a significant portion of the total cost of the phase 1 MEH demonstration scheme, because, in this phase, the MEH must be designed, new capacity and new partnerships formed to install and operate it, the system refined and evaluated and all the key stakeholders convened to make a decision on phase 2. The

incremental costs of this first phase are therefore likely to be at least 50% of its total cost.

A necessary condition for moving to phase 2 will be to demonstrate that the full-scale MEH is justified on cost-benefit grounds and can become financially self-sustaining. A much lower proportion of phase 2 costs will therefore be incremental and qualify for GEF funding.

Cost benefit

Benefits

Reduced risk of environmental catastrophe

The principal benefit of the Marine Electronic Highway is expected to be reduced risk of environmental damage from a catastrophic shipping accident in the Straits of Malacca and Singapore. While even without the implementation of the MEH the risk of such an accident is low, the environmental and social cost of such an accident would be very high. This benefit of the MEH would therefore be measured as a small reduction in the probability of an unlikely but costly event.

The costs of the event could be measured in several ways. The simplest might be from the compensation claims from those damaged by the event, plus the financial cost to those causing the event. The most complex might be assess the many separate environmental impacts and the cost of remedying them.

Other environmental benefits

The MEH would have many additional benefits, some environmental, some marine safety but most would be reduced maritime operating costs. The environmental benefits could come from the avoidance of dumping of ship waste and bilge in an environmentally sensitive environment, while the safety impacts could include a reduction in accidents that did not involve oil spill and were therefore not accounted for in the principal benefit measure.

There are potential less direct economic benefits derived from these environmental benefits, but these would be even harder to estimate and measure. If the reduction in pollution in the Straights were significant, there could be a potential for increased fishing, marine farming and tourist development. However, it would be difficult to estimate and evaluate such benefits with the same level of confidence as could be attached to the direct environmental benefits.

Ship operating costs – ship loading

The reduction in ship operating cost come in at least two ways. First, bulk takers and possibly container ships, could be loaded closer to the depth of the channel. The electronic navigation charts could provide more detailed and updated information than is presently available. If combined with current weather and tide information, this could give a significant advantage to ships that make use of the MEH systems, Indeed, it is this benefit that would be the incentive for most of them to participate.

Ship operating costs – avoidance of longer voyages

Another ship operating benefit could come from an increase in the capacity of the Straights and therefore an avoidance of ships having to use longer and more time consuming alternative routes.

Financial and economic benefits

Most of the assessments of ship operating costs (and therefore benefits of the project through a reduction in those costs) are measured in financial , so some effort would need to be made to convert these financial benefits so that they measure economic benefits.

Costs

Investment costs

The costs of the MEH would be much more easily measured than the benefits. There would be investment costs to be mad by the littoral states in setting up the facilities (electronic navigation charts, buoys and land stations for transmitting data) for the MEH to operate, and there would be some additional costs to ship operators in providing equipment for their vessels to make use of the systems.

Most of these investment costs will be measured as part of the cost of setting up the MEH Demonstration Project.

Operating costs

The littoral states would also incur operating costs in keeping the electronic charts updated and operating the buoys and other equipment for recording weather and tide information. There would be operating costs incurred by the IMO in collecting and making the data available to the ships participating in the system. The ship owners would incur additional operating costs in training ships crew to receive, interpret and act on the information provided by the MEH.

Most of these operating costs will be estimated as part of the implementation of the MEH

As with the benefits measures, cost estimates made in financial terms will need to be converted to economic units.

2. Financial (see Annex 4 and Annex 5):

NPV=US$ million; FRR = % (see Annex 4)

Maritime safety and environmental management in the Straits of Malacca and Singapore, particularly on the prevention and response to oil pollution arising from discharge and spillage by ships have been largely carried out by the three littoral States of Indonesia, Malaysia and Singapore including the financing of safety facilities and mechanisms. International assistance in combating oil spills in the Straits has been provided by Japan and to a limited extent, by other countries. Evidently, the costs of installing, maintaining and managing the aforementioned facilities and measures are financially taxing to the littoral States. Compensation for the costs that the littoral States have incurred for the Straits cannot be easily realized as international law prohibits them to charge for a toll or other fees merely for passage through the Straits (Article 26 of 1982 UNCLOS). However, the UNCLOS allows a coastal State to charge for specific services rendered to a ship.

The Marine Electronic Highway (MEH) system in the Straits of Malacca and Singapore is envisaged to be a financially sustainable enterprise based on voluntary use or subscription of the system's products and services for enhanced navigation and environmental management. The MEH system has three features, namely, a network of maritime safety and marine environment protection systems and facilities, a governing or corporate body and three MEH Data Centres (MDCs). The overall management of the MEH system will be distinct from the management of the Straits of Malacca and Singapore. Therefore, the operation and actual maintenance of navigational facilities will remain with the relevant authorities of the three littoral States. It is further envisaged that the MEH system will limit the financial burden of the littoral States to provide for and maintain navigational aids and facilities in the Malacca Straits but enhancing monitoring and emergency response, especially in the event of chemical and oil spills.

Given that a coastal State can levy charges from users of the a strait under Article 26 of UNCLOS,

the feasibility of generating revenues from the establishment of the MEH system in the Straits of Malacca and Singapore is certainly achievable. Having such revenues could obviate the need for the 3 littoral States and other donors to continue to carry out the financing of maritime safety and pollution prevention facilities in the Straits. The revenues will be generated from the application of a sustainable financing mechanism through public-private sector partnerships to establish, operate and manage the MEH system. A financing system for the MEH system to administer and manage the revenues and other funding will be established and hereto called the MEH Fund.

Financing Plan US$Million

Source	Local	Foreign	Total
Indonesia	0.2	0.0	0.2
Malaysia	0.8	0.1	0.9
Singapore	0.6	0.2	0.8
Intertanko	0.0	5.6	5.6
GEF	2.2	5.8	8.0
Total	3.7	11.7	15.5

Notes: Indonesia is seeking assistance from JICA in funding its share
Malaysia will fund its share from government sources
Intertanko has committed its members to equip a minimum of 60 ships to take part in the Demonstration Project

Fiscal Impact:

3. Technical:

From the technical standpoint, the critical aspects in the development of the MEH system would be the integration of maritime safety technologies and marine environment protection systems and the establishment of the managing tool. 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 internalise the development of the MEH system and propel it to its completion. The co-operation initiated during the PDF Block B phase will be strengthen 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 provides and users).

4. Institutional:

The littoral States of Indonesia, Malaysia and Singapore are the major players in 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 the Demonstration Project by providing in-kind contributions such as the use or access of maritime safety facilities, office space, equipment, utilities and local experts. The littoral States with their designated National Focal Points and lead/implementing agencies will be working with the project team in partnership with relevant stakeholders to implement the activities of the 7 components of the Demonstration Project including the development of the MEH Fund and the governing body of the MEH system. 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.

Currently, the Demonstration Project has, as its partners, the International Association of Independent Tanker Owners (INTERTANKO) and the International Hydrographic Organization (IHO). The partnership with INTERTANKO will ensure that adequate tankers will be made available for the technical evaluation of the MEH system. INTERTANKO will be the focal point for the shipping industry and will identify ships that will be participating in the project (e.g., 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 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. As a partner, INTERTANKO will be a member of the Project Steering Committee and also 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.

As a partner, IHO will also be a member of the Project Steering Committee and also 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. Its major inputs to the project will be to provide technical assistance in the development and production of 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, funding) from among its member states for the development of the Straits ENCs and related products.

Private sector partners such as technology providers, especially those engaged in digital technology and telecommunications as well as those in the environment sector will be involved in the development of various products and services of the MEH system covering online and real time communications and data exchange, establishment of VPN, packaging and marketing, development of the MEH Fund as well as actively participate in the PSC and its Technical Committees and Working Groups.

4.1 Executing agencies:

International Maritime Organization, Governments of Indonesia, Malaysia and Singapore.

4.2 Project management:

The Project Steering Committee (PSC) established during the PDF Block B Grant period will continue 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 Project. The PSC is comprised of designated National Focal Points from Indonesia, Malaysia and Singapore, representative from GEF/World Bank, IMO, PEMSEA, INTERTANKO, IHO, private sector and other partners. IMO will serve as the Secretariat 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 Project.

In the MEH Demonstration Project, various activities under Component 3, 4 and 5 on developing the operational, administrative and financing mechanisms for the sustainable management of the MEH system will be implemented that will assess the evolution of the PSC into a corporate entity with its organizational structure, corporate rules and financing mechanism. Further refinement of the results of the assessment will be carried out in the MEH Full-scale Development Project. It is envisaged that the corporate body will be established through a ministerial conference at the latter part of the Full-scale Development Project.

The PSC will have four standing Technical Committees (TC) and two-*ad hoc* Working Groups (WG). The TC and WG will assist the PSC in monitoring and evaluating the implementation of project activities as well as providing technical guidance to the Project Management Team (PMT) tasked with the implementation and management of the project including the development of charging mechanism, the MEH Fund and institutional arrangements to establish a governing body for the MEH system. A project office will be established as a work base for the PMT. The location of the project office will be decided by the PSC. The WG will review and evaluate project outputs, particularly those relating to the transition from the pilot demonstration to the full-scale MEH Project (Component 7) and assist the PMT in the development of project proposal for the MEH Full-scale Development Project and in the development of the managing tool or governing body.

4.3 Procurement issues:

Each country with use its own procurement procedures for equipment and civil works funded from its own sources. Intertanko will rely on its ship-owning members to equip their own ships using their company procurement procedures. The IMO will use its procurement procedures, which are compatible with those of the World Bank, for the procurement of consultants (for undertaking studies, building of mathematical models, and for support of the Project Steering Committee, Technical Committee's and Working Groups), for gathering the hydrographic data and production of the Electronic Navigation Charts (under ICB procedures) and for equipment for the Project Management Office. Premises for the Project Management Office will be provided (at cost) by the participating country selected for the location of the office. Although the IMO will contract for the production of the ENCs (the hydrgrpahic data and charts) hydrographic data and charts themselves will remain the property of the respective countries. However, it will be a condition of their participation in the Demonstration Project that the charts be made available at no charge to the MEH Project Management Office.

4.4 Financial management issues:

The GEF funds will be managed by the IMO and by the governments of Malaysia and Indonesia. Each of these has managed World Bank and/or GEF projects in the past.

5. Environmental: Environmental Category: C (Not Required)

5.1 Summarize the steps undertaken for environmental assessment and EMP preparation (including consultation and disclosure) and the significant issues and their treatment emerging from this analysis.

The marine environment protection system (EMPS) component of the MEH system is an amalgamation of several models and systems. The demonstration project will evaluate several EMP models and systems for integration into the MEH system including meteorological and oceanographic systems. The EMPS that will be evaluated are the following: 3-Dimensional hydrodynamic model; oil spill trajectory and fate model; coastal and ocean monitoring systems (e.g., tides and current); environmental impact assessment; oil spill damage assessment model and sensitivity mapping. 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.

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 sandwaves 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.

5.2 What are the main features of the EMP and are they adequate?

EMP not required

5.3 For Category A and B projects, timeline and status of EA:
Date of receipt of final draft:

5.4 How have stakeholders been consulted at the stage of (a) environmental screening and (b) draft EA report on the environmental impacts and proposed environment management plan? Describe mechanisms of consultation that were used and which groups were consulted?

N.A.

5.5 What mechanisms have been established to monitor and evaluate the impact of the project on the environment? Do the indicators reflect the objectives and results of the EMP?

N.A.

6. Social:

6.1 Summarize key social issues relevant to the project objectives, and specify the project's social development outcomes.

6.2 Participatory Approach: How are key stakeholders participating in the project?

Relevant stakeholders of the MEH Project are the national and local governments in the three participating countries of Indonesia, Malaysia and Singapore, partners in the shipping and the maritime communities and user States, the private sector (technology providers and users), the scientific community, nongovernment organizations and other users of the Straits. Part of the assessment of the technical functionalities of the MEH system will involve ship-based and offshore linkups, for example, the ECDIS-AIS-telemetry/buoy systems. Also, the evaluation of the ENC-ECDIS for navigation in critical areas of the Straits and the influx and exchange of information will require land- and ship-based interactions (e.g., ship to ship, ship to shore and offshore facilities to shore or ship). Thus, the participation of the shipping sector and the maritime community in general will be crucial in demonstrating the effectiveness, viability and value-added contribution of the MEH system to maritime safety and marine environment protection. In this demonstration stage of the MEH Project, additional land-based and offshore facilities and equipment need to be installed or upgraded. For ship-based facilities and equipment, the project will take into account the mandatory requirements under the revised SOLAS Chapter V, such as the installation of AIS and the need for ships, particularly new or refurbished ships to be fitted with improved Integrated Bridge System. Thus, the participation of the shipping sector in the demonstration project will take into consideration their plans and activities to install AIS and ECDIS onboard their fleets, which will be their co-financing contribution to the project should they agree to become partners.

6.3 How does the project involve consultations or collaboration with NGOs or other civil society organizations?

6.4 What institutional arrangements have been provided to ensure the project achieves its social development outcomes?

6.5 How will the project monitor performance in terms of social development outcomes?

TBD

7. Safeguard Policies:

7.1 Are any of the following safeguard policies triggered by the project?

Policy	Triggered
Environmental Assessment (OP 4.01, BP 4.01, GP 4.01)	○ Yes ● No
Natural Habitats (OP 4.04, BP 4.04, GP 4.04)	○ Yes ● No
Forestry (OP 4.36, GP 4.36)	○ Yes ● No
Pest Management (OP 4.09)	○ Yes ● No
Cultural Property (OPN 11.03)	○ Yes ● No
Indigenous Peoples (OD 4.20)	○ Yes ● No
Involuntary Resettlement (OP/BP 4.12)	○ Yes ● No
Safety of Dams (OP 4.37, BP 4.37)	○ Yes ● No
Projects in International Waters (OP 7.50, BP 7.50, GP 7.50)	● Yes ○ No
Projects in Disputed Areas (OP 7.60, BP 7.60, GP 7.60)*	○ Yes ● No

7.2 Describe provisions made by the project to ensure compliance with applicable safeguard policies.

Management of the Project will be undertaken by the International Maritime Organization, the agency responsible for environmental issues in international waters. The Governments of Indonesia, Malaysia and Singapore are also parties to the proejct through their respective environmental agencies, responsible for territorial water

F. Sustainability and Risks

1. Sustainability:

Since the establishment of the Traffic Separation Scheme in the Straits of Malacca and Singapore, various regional and international workshops and conferences on the Straits had debated on how to distribute the financial burden of the littoral States to users (i.e., direct user States and non-state users) but without any concrete and practical solutions.

The establishment of the MEH system in the Straits provides for a practical and tangible solution that littoral States, users and other stakeholders can collectively understand and support. The creation of the MEH Fund can further appeal to the stakeholders, especially the littoral States due to regional benefits that it could generate through the Environmental Trust Fund (see purposes of the MEH Fund). At the national level, the Fund could subsidize activities that will enhance environmental monitoring, especially in coastal areas and ecologically sensitive sea areas or habitats, capacity building and integrated information sharing for environmental impact assessment, risk assessment and management including damage assessment (e.g., for oil spill damage compensation).

1a. Replicability:

2. Critical Risks (reflecting the failure of critical assumptions found in the fourth column of Annex 1):

The Demonstration Project risks to the development and establishment of the MEH Fund 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 Project means that ample time and efforts will be provided for the development and establishment of the MEH Fund. Such duration will allow the implementation of activities that will remove policy, legal, financial and management barriers as well as the strengthening of public-private sector partnerships, especially in product/service development.

Potential risks

Sources of risk

Political

Given that this is a multi-national project, requiring the cooperation of countries that have not always had cordial relations with each other, there are a number of intrinsic risks that a normal project would not have. In addition, the Marine Electronic Highway itself will be in international waters, where the authoritative institution is the International Maritime Organization. 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 persuasion.

Managerial

The demonstration MEH 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 coordination of these activities will require a strong management effort based on a long period of experience in dealing with similar multi-national, high technology projects.

Technical

A second set of risks derives from the pilot nature of the demonstration project. The MEH demonstration project will be the first to implement a coordinated set of marine operational and environmental tools, and as such is subject to the risks of any demonstration project.

Financial

The third set of risks derives from the projects dependence on support from the shipping industry, in particular the ship operators who make most use of the Malacca and Singapore Straits.

Mitigation of risks

The design of the MEH demonstration project has a number of significant features that are designed to minimize these risks.

Political

During the project preparation phase, the three countries involved in the project have demonstrated a high level of cooperation and coordination of their respective activities. The IMO has prepared draft Memoranda of Understanding to be signed by all participating countries and agencies, that indicate their commitment to help achieve the objectives of the demonstration project. These letters will be signed before presentation of the project to the GEF Board. A

second round of Memoranda of Commitment will be signed before negotiation of the project. These memoranda will spell out the specific commitments of each of the countries and agencies whose participation is essential to the success of the project.

Managerial

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 in the mutual interest of a group of maritime littoral states. The day-to-day management of the project will be provided by a specially recruited project management team that will be responsible to a Project Steering Committee (PSG), which will be chaired by the IMO. The PSG will be assisted by two working groups and four technical committees drawn from the appropriate marine and environment institutions in the three littoral states.

Technical

While the inclusion of a wide range of electronic navigation and environmental control procedures is innovative, the technology of each of them has already been demonstrated and proven. The technical specifications of all the electronic equipment to be used in the project are based on existing definitions and agreements made by the IMO and International Hydrographical Institute. None of the equipment to be use din the project is subject to patent or similar restrictions and there are multiple suppliers of each item to be procured. So the principal remaining technological risk is in the provision of the software and models that will be needed for their successful coordination. Since this 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, despite the designation of the project as a demonstration project.

Financial

Principal funding for the project will come from the GEF and shipping operators, with their combined contribution amounting to some 70% of the total. The remainder will be provided by the participating states, much of it as in-king contributions. Intertanko, an international shipping association that has some 240 members that represents more than half the world's fleet of tankers over 10,000 dwt, has committed to ensure that it members will provide a minimum of 60 ships that are fully equipped to implement the systems of the demonstration MEH. Since these ships are among those that make the most use of the Straits and are at greatest risk of being involved in a marine incident that could involve a significant spill of oil, this commitment is considered sufficient to provide a demonstration of the MEH principles. Nevertheless, 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.

Each of the states and Intertanko has already committed to its financial contribution and these commitments will be conformed in the Memoranda of Understanding.

Risk	Risk Rating	Risk Mitigation Measure
From Outputs to Objective		
Future charges for using MEH facilities will discourage users	M	Ship operators are part of Project Managment team and will be able to influence design of MEH to meet their needs
Authority of IMO to charge for use of facilities in international waters will be challenged by ship owners and operators	S	Aothority of IMO is widely accepted. Ship owners will continue to have choice to avoid charges by free passage in Straits without using MEH facilities
Participating countries will be unable to agree on administration mechanism of MEH	M	Project design and benefits will give countries high incentive to cooperate with each other.
From Components to Outputs		
Not enough vessels will be equipped to use MEH facilities	M	One ship-owner agency has already committed that its members will supply at lest 60 adequately equipped ships
Integration of MEH tools will be too difficult	M	No new technology will be needed. At worst, systems can function independently of each other
Participating countries will be unable to agree on location of Operations Center		IMO already has experience of dealing with unwilling cooperating countries in similar proejcts (Indian Ocean Islands)
Overall Risk Rating	M	

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

3. Possible Controversial Aspects:

G. Main Conditions

1. Effectiveness Condition

2. Other [classify according to covenant types used in the Legal Agreements.]

H. Readiness for Implementation

☐ 1. a) The engineering design documents for the first year's activities are complete and ready for the start of project implementation.

☐ 1. b) Not applicable.

☐ 2. The procurement documents for the first year's activities are complete and ready for the start of project implementation.

☐ 3. The Project Implementation Plan has been appraised and found to be realistic and of satisfactory quality.

☐ 4. The following items are lacking and are discussed under loan conditions (Section G):

I. Compliance with Bank Policies

☐ 1. This project complies with all applicable Bank policies.
☐ 2. The following exceptions to Bank policies are recommended for approval. The project complies with all other applicable Bank policies.

Hatim M. Hajj	Jitendra N. Bajpai	N
Team Leader	**Sector Manager/Director**	**Country Manager/Director**

Annex 1: Project Design Summary

EAST ASIA AND PACIFIC: 4E-Marine Electronic Highway

Hierarchy of Objectives	Key Performance Indicators	Data Collection Strategy	Critical Assumptions
Sector-related CAS Goal: Conserve natural resource base of the Straits of Malacca and Singapore to reduce poverty of coastal people.	**Sector Indicators:** Condition of coastal and marine resources.	**Sector/ country reports:** Environmental assessments	**(from Goal to Bank Mission)**
GEF Operational Program: Reduce ship-based contamination of a biologically rich shared water body.	**Outcome / Impact Indicators:** Frequency and severity of ship-based environmental damage to marine resources.	Littoral states marine incident and pollution monitoring systems.	The majority of larger ships use the MEH system. The system is capable of reducing accidents and spills The system is financially sustainable
Global Objective: Establish the Marine Electronic Highway and demonstrate its technical functionalities on navigation safety and marine environment protection for the Straits of Malacca and Singapore	**Outcome / Impact Indicators:** ▪ Operationalization of pilot MEH system ▪ Validated implementation and operational plan for a full-scale MEH system ▪ Fully operational MEH infrastructure (pilot) in strategic areas of the Straits ▪ Availability of high resolution ENCs for the TSS ▪ Replication and adoption of the MEH system in congested or confined waters along the Straits and beyond Enhanced navigational safety and improved marine pollution prevention and response ▪ Improved delivery of environmental data and services ▪ Improved regional marine pollution networking ▪ Reduction of marine pollution along the Straits ▪ Establishment of a corporate body to operate and manage the MEH system in the context of Article 43 of UNCLOS and public-private partnership ● Improved user and littoral States cooperation in maritime safety and reduction of transboundary marine pollution ▪ Validation of the financial plan for a full-scale MEH system	**Project reports:** ▪ Technical assessment reports on the establishment of the MEH system ▪ Technical Committee and Working Group meetings ▪ Annual PSC meeting ▪ Quarterly and annual reports ▪ Test run and intercalibration	**(from Objective to Goal)** All the littoral States must be level players to benefit from the establishment of the MEH system Operation of the navigational aids and shore-based maritime safety facilities will remain with the designated authorities of the littoral States but it is crucial that information be shared for the MEH system Cooperation among agencies is vital Environmental agencies in the littoral States must play an active role in the integration of EMPS to the MEH system Information sharing is crucial in the development of products and services for the environmental sector clientele Policy and other legal barriers must be addressed such on sharing of information

	▪ Establishment of a voluntary sustainable financing mechanism ▪ Implementation of the MEH Full-scale Development Project ▪ Establishment of the international trust fund ▪ Pilot charging mechanism operating ▪ MEH Fund blue print drafted Feasibility study for second phase initiated		and resources, copyright and limitations imposed by international and national regulations that could undermine effective and efficiency flow and exchange of information and resources for the MEH system
Output from each Component:	**Output Indicators:**	**Project reports:**	**(from Outputs to Objective)**
1. Establish the Marine Electronic Highway	• Quantified changes and benefits arising from the introduction of the MEH system • Improvement in gov-ernment programmes and activities on navi-gational safety and marine pollution pre-vention and response • One DGPS Broadcast Station established and operational • Upgraded tide stations with telemetric capability • 2 AIS base stations established and opera-tional • 1 offshore station for oceanographic data collection established and operational • Survey data, and ENCs • DTM of submarine geomorphology of selected areas of Straits • Guidelines and protocols prepared • Seminars organized New potential tech-nologies evaluation and integrated into the MEH system	▪ PSC through the Technical Committees (TC) and Working Group (WG) to review the activities, monitor and evaluate the implementation ▪ Progress reports ▪ Milestone reports ▪ Technical reports on the results of activity implementation. ▪ Factory testing, delivery installation, commissioning and acceptance trials monitor and evaluate by Project Management Team (PMT). Technical reviews updates and includes emerging technology in the technical specifications and action plans.	Relevant stakeholders will provide the required data that are critical to the quantification of the benefits of the MEH system Timely delivery of commitments by the participating States and other stakeholders. TC reports to PSC for work progress and development. Equipment procurement adheres to WB procedures and practices. Keeping track of emerging technology development maintains up to date mode of overall MEH Project. Fast development in ICT requires flexible and timely interventions.
2. Facilitate integration of marine environment systems and data flow and information exchange through the MEH system	▪ Guidelines and protocols prepared ▪ Seminars organized ▪ Expanded and improved MEH system ▪ Validated sandwaves model for a specific area of the Straits ▪ 3 MDCs established and operational ▪ Chemical and oil pollution models field tested and effectively used ▪ Measurable indicators and assessment criteria for environmental management and pollution prevention tested and adopted for the MEH system environmental models	▪ Technical reviews and evaluation reports. ▪ Progress and milestones reports. ▪ MDC staff interacts and liaise with PMT in close consultation. ▪ Project meetings and workshops Technical Committee and Working Group meetings	Systematic integration of environmental information on ENC requires industry support. Telemetry communications requires support from telecommunications network in the region. Ship shore communication via satellite is well-established world wide. Sharing of information requires the consensus and openness of littoral States in achieving a common seamless database to create decision support systems for maritime safety and environmental management. Information sharing requires openness and willingness to provide access to in-country databases

3. Development of Operational and Administrative Mechanisms	▪ 3 MDCs established and operational ▪ Intergovernmental and project meetings ▪ Blueprint of the managing tool developed Technical Committees and Working Groups established	Annual PSC meeting Technical reviews and milestone reports. Cooperative agreements Quarterly and annual reports	Organization mechanism under the PDF Grant worked well and is adopted. Sensitivity to local cultures and background aids negotiation and decision process leading to smooth consensus. Recognition of shared responsibility for transboundary marine pollution problems in the Straits will serve as impetus for closer co-operation and mutual sharing of information and resources.
4. Evaluation of financial, social and economic benefits and legal issues	▪ Potential MEH users identified ▪ Criteria and measurable indicators for financial and socioeconomic assessment for the MEH system and its impacts developed ▪ Valuation of MTN and extra-MTN products and services ▪ Pilot charging mechanism established ▪ MEH Fund blueprint developed ▪ PPP Programme developed ▪ Investment projects for PPP developed ▪ Benefits of the MEH system quantified ▪ Revenue from the pilot MEH generated ▪ Expanded client base and partners ▪ Funding for the MEH Full-scale Development Project established	Workshop reports, technical reviews and recommendations. Assessment reports (socioeconomic, financial and market). Workshops and consultative meetings MOUs and, or agreements Quarterly and annual reviews Annual PSC meeting Technical Committee and Working Groups meeting	Policy and other legal barriers must be addressed such on sharing of information and resources, copyright and limitations imposed by international and national regulations that could undermine effective and efficiency flow and exchange of information and resources for the MEH system The products and services of the MEH system must be functionally attractive, efficient and effective to ensure wide client base and partners (private sector and user States). Quantifying the incremental cost of the MEH system products and services will be crucial in the development of the MEH Fund
5 Promote awareness and participation relevant stakeholders	▪ 3 national and 2 regional workshops organized and held ▪ 5 special seminars organized and held ▪ 2 users feedback meetings organized and held ▪ A directory of users and expanded client base ▪ Enhanced national and regional capacity ▪ Publication of technical reports and project newsletter Publication of promotional materials on the MEH system	Reports and reviews Newsletters, brochures, audiovisual materials (digital) Annual PSC meeting Workshops and seminars Internet dissemination of project information	The involvement of potential users, especially from the environment sector as well as the national maritime sector will have significant impact on the client base and the products and services being offered by the MEH system Compliance to standards and quality control must be met at all times as clientele expands
6. Capacity building, evaluation and project management	▪ 1 regional training organized ▪ 3 short term training organized ▪ Training materials prepared and used ▪ Joint exercises Trained national staff assigned to the MDCs and Hos	Training course assessment Progress and annual reports Annual PSC meeting	National staff trained should be assigned to the work that they are trained for and not transferred to other posts to ensure effective and efficient operation of the MEH system.
7. Implement transitional activities and assess feasibility of second phase	Database on impacts of MEH system established Project document for MEH Full-scale Development approved for implementation Feasibility study for second phase initiated International forum on second phase organized and held Preliminary assessment of MEH Impacts on shipping and environmental sector carried out	Technical reports, annual and quarterly progress reports Project Document on the MEH Full-scale Development Annual PSC meeting International forum on second phase	All the components are interlinked and outputs of some activities are inputs to other components so that proper implementation of activities must be ensured.

Project Components / Sub-components:	Inputs: (budget for each component)	Project reports:	(from Components to Outputs)

Annex 2: Detailed Project Description
EAST ASIA AND PACIFIC: 4E-Marine Electronic Highway

By Component:

Project Component 1 - US$11.30 million

Component 1: Establish the Marine Electronic Highway and demonstrate its technical functionalities with respect to maritime safety and marine environment protection for the Straits of Malacca and Singapore.

The existing maritime navigation, safety and marine environment equipment and systems in the 100km section of the Straits that has been selected for the MEH demonstration project will be upgraded and integrated to establish a fully-functioning MEH system in this section. The system will produce large-scale resolution environmental forecasts, extremely precise ship traffic management information (covering both through and cross-channel traffic), real time ship-to-shore communications, and large-scale resolution electronic charting information for navigational use by ships passing through the Straits. The following sub-component activities will be undertaken to produce these outputs:

1. Finalization of the MEH boundaries and upgrading of existing marine technology infrastructure in the boundary area of the MEH demonstration system.

The MEH demonstration system's precise geographical boundaries will be confirmed by the participating governments. In collaboration with representatives of key system users, including Intertanko, the system's technical infrastructure requirements will be finalized. Exisiting Differential Global Positioning System (DGPS) facilities, Automatic (ship) Identification Systems (AIS), Vessel Traffic Service/Management (VTS) and Environmental Management and Protection Systems (EMPS) will then be upgraded to achieve full MEH system functionality.

The major new on-shore facility to be established is a DGPS Broadcast Station in Sumatra. Two new AIS Stations and 1 Offshore Station for oceanographic data collection will also be established. Six existing operating tide stations will be upgraded with telemetry capability.

2. Upgrading of Electronic Navigation Charts.

Currently available digital Electronic Navigation Charts (ENCs) for the MEH demonstration section of the Straits of Malacca and Singapore are (with the exception of the Singapore Strait, Sectors 7 to 9), incomplete, based on inaccurate and outdated paper charts, of various different degrees of resolution, and are of insufficiently high resolution for precision navigation.

In collaboration with the three national hydrographic institutions, a hydrographic survey using multi-beam technology with DGPS will be undertaken for the STRAITREP sectors 1 to 6, which includes the entire Traffic Separation Scheme from One Fathom Bank to Tanjung Piai and the port approaches to Port Klang, Malacca, Dumai and Sekupang in Batam. Sectors 7 to 9, which cover the Singapore Strait, will not be resurveyed as adequate large-scale (1:10,000) ENCs are already available for them. From this survey, a comprehensive set of high resolution electronic

charts will be produced that are fully consistent with IHO S-57 ENC standards. The three national agencies responsible for chart production will all use the same tools for digital chart compilation and a common suite of software and hardware, which will enable the ENC data produced by each country to be seamlessly meshed together into one comprehensive ENC service for the MEH demonstration system area.

3. Installation of ship-based MEH equipment

At least 60 large oil tankers owned by members of the International Association of Independent Tanker Owners (Intertanko), more than Y other large tankers, and at least X large container ships that regularly pass through the Straits of Malacca and Singapore will be equipped with the standardized ship-based electronic equipment that is required to fully use and test the benefits of MEH demonstration system. The major piece of equipment that these ships will install and operate is an Electronic Chart Display and Information System (ECDIS). ECDIS is a real-time navigation system that combines and graphically displays state-of-the-art navigational information (including the ENC for the area through which the ship is passing). When combined with Differential Global Positioning System data, this ECDIS information allows the mariners controlling these ships to continuously determine their vessel's position in relation to land and charted objects (reefs, sandbars, wrecks, etc) and to exercise precise control of their ship. In addition to electronic charts, radar images, including AIS information, can also be displayed, which enhances the mariner's tactical understanding of his surroundings. Provision of this comprehensive, real-time navigational information will significantly reduce the risk to user ships of ship collisions and/or groundings. The ECDIS will be complemented by Automatic Indentification Systems (AIS), which allow shore-based controllers to identify and monitor the ship's position, course and speed and to alert the mariner to any nearby shipping or obstructions. It will also help them to identify the source of any illegal bilge water discharges and thus deter this practice.

4. Development and assessment of the integrated technical functionalities of the MEH system for maritime safety and marine environment protection.

This sub-component will harmonize and package the various technologies that will comprise the MEH, so that it functions as a coherent, accurate, reliable and efficient system under different maritime, environmental and meteorological conditions and fully meets the demands of its multi-sectoral users, operators and data providers. Such functionalities will cover both marine safety and environmental protection. In addition to its basic navigational information display, call up, transmission and download features, the advanced functionalities envisaged for the MEH system include the ability to provide real time 3-D information (e.g., water column and seabed, in addition to surface features); traffic conditions, especially along critical parts of the TSS; and environmental data along its route (inter-operability) including model results. These functionalities will be developed, evaluatedand fine-tuned to meet the various user requirements, which include: real-time user communication, user accessibility, inter-agency and inter-country multiple data flow and transfer, Internet connectivity, vessel identification and detection (e.g. discharges of ballast water and oil pollutants), and emergency response capabilities (search and rescue, oil spill), among others.

5. Augmentation of the MEH system with new and emergent technologies on maritime safety and marine environment protection.

The pace of development of maritime navigation and environmental technologies is very fast, propelled by the rapid advancement in information and communications technology. It is anticipated that improved or new technologies will become commercially available during the development of the demonstration project. This activity will assess the options to integrate emerging improved or new technologies and processes to enhance the MEH system and keep it up-to-date, including the application of new standards and performance criteria, as well as acceptance and compliance with the needs of stakeholders and other entities (e.g. international bodies).

Project Component 2 - US$0.61 million

Component 2: Facilitate the integration of national marine environment data systems, information exchange and institutional collaboration on marine environment management.

This component will design, develop and demonstrate collaborative use by the national marine and environment agencies of a Marine Environment Protection System (EMPS) for the Straits of Malacca and Singapore. A core of the EMPS will be a centralised marine environment database or repository system shared commonly by these agencies in the three littoral States and accessed through the MEH Data Centres (MDCs). Key marine environment data, particularly hydrographic and oceanographic data, will be collected by installing sampling devices attached to buoys. Data will be transmitted continuously by telemetry. All data arriving at the MDCs will be automatically stored in the centralized database where it will be processed and packaged according to an agreed format, based on the national users' specifications. It will then be accessible by the littoral states' maritime and environment institutions either offline or in real time mode via a Virtual Private Network (VPN). Other relevant existing marine environmental data, such as ecological and meteorological data, will be transferred to the database system by the cooperating national institutions or agencies.

Selected data sets will be processed for use in various environmental management and navigation models such as:

- 3-D hyro-dynamic model;
- Sensitivity maps;
- Oil spill trajectory and fate model; and
- Weather forecast.

The ENCs that will be produced from the hydrographic survey using multi-beam technology will serve as base maps for these models and for the sensitivity mapping. Eventually, sandwave and shoal models and 4-D models of critical areas will be developed in support of navigational safety and pollution prevention. At the national level, the data will facilitate environmental impact assessment and damage assessment (from oil and chemical pollution). Locally, it will improve the mapping of coastal and marine biodiversity and facilitate the development of sensitivity maps, which can be incorporated into coastal and marine environment management plans and

activities. 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 with the MEH system outputs.

A multi-agency demonstration of how the EMPS can be used to strengthen marine pollution prevention and/or environmental management plans and activities will be organized in each of the participating countries. These demonstrations will involve both the national and local level marine and environmental management institutions.

The component includes the following specific activities:

1. Integration of marine and coastal management information systems into the MEH system.

Currently, data from monitoring programmes on coastal management, the coastal environment and marine pollution such as SMEIS, fisheries, SEAWATCH (including remotely sensed and spatial data) are generally not available online. This activity will assess the technical challenge of integrating existing marine environmental and associated data and databases into the MEH system. It will be undertaken in conjunction with market survey to identify potential users and their needs will include a cost-benefit analysis to assess the financial implications on the part of the data providers and users.

2. Integration of meteorological and oceanographic data into the MEH system.

Tide, current, wind and weather are the environmental data most commonly used in the maritime sector to aid navigation, especially in precautionary areas such as the Straits. This activity will integrate the currently available meteorological and oceanographic data, including forecasts, into the MEH system, in conjunction with the new technical functionalities of the system (e.g., ECDIS-AIS-telemetry/buoy systems). This activity will also link with the profiling and modelling of sandwaves and in emergency response (pollution and search and rescue).

3. Profiling and modelling the sandwaves phenomena in selected areas of the Malacca Straits.

One of the maritime hazards in the Straits of Malacca and Singapore, particularly along the TSS from One Fathom Bank southwards, is the presence of sandwaves. Sandwaves are moving sandy sediments that attain maximum vertical extent following periods of relatively calm weather or neap tides and therefore at the most critical navigational conditions. While sandwaves are monitored through the use of echo sounders, minimal studies have been undertaken on the location and movement of sandwaves in the Straits. This activity will integrate various oceanographic and meteorological data and multi-beam technology to assess the physical profile of the sandwaves in the Straits as well as the possibility of forecasting their conditions. This activity will provide better information on under keel clearance of ships.

4. Evaluation of the the MEH system's potential to improve marine pollution prevention and

response.

One of the lessons learned from the experience with 'EVOIKOS' and 'NATUNA SEA' oil spill incidents was the need for quicker response. While relatively quick response is possible with the present oil spill response framework, the existing response outfits are not well integrated into a unified system. This activity will evaluate the applicability of the MEH system for improving the regional marine pollution prevention and response during emergency situations and for routine monitoring. Chemical spills or incidents involving hazardous and noxious substances will also be included in the assessment.

5. Development and evaluation of mechanisms for the long-term management of data and information exchange for the MEH system.

This activity will design the environmental data processing, storage and retrieval systems and their links to the navigational information databases and information. It will address data and services maintenance, up-dating, data management and quality control, including data warehousing, performance and compatibility issues of the MEH system as a whole. The institutional, financial, administrative arrangements will be evaluated to ensure that the information and services provided by the MEH system are sustained over the long term.

Project Component 3 - US$ 0.73 million

Component 3: Develop the operational and administrative mechanisms for the sustainable management of the MEH system.

The component will identify and develop the most appropriate institutional mechanisms for the operation, administration and management of the MEH system, with the help of inputs from relevant stakeholders at the national, regional and international levels. Account will be taken of the provisions of relevant international conventions, agreements and protocols that relate to navigation in the Straits of Malacca and Singapore, including Article 43 of the 1982 UNCLOS.

The operation, administration and management of the MEH system will be distinct from and will not usurp any of the functions and responsibilities of the exisiting national and regional institutions that manage the Straits of Malacca and Singapore. The management of maritime traffic will remain the responsibility of the littoral States and designated authorities that have been mandated to discharge such responsibility, i.e., Directorate General of Sea Communications (Indonesia), Marine Department (Malaysia) and the Maritime and Port Authority (Singapore). Various co-operation systems among the three littoral States on safety of navigation and marine pollution prevention and management already exist. For instance, the Tripartite Technical Expert Group (TTEG) was established in 1971 by the three countries for the safety of navigation in the Straits. In a similar vein, the MEH system will require an institutional anchor, which could be an extension of existing mechanism, such as the Project Steering Committee, the TTEG or an entirely a new set up.

The institutional arrangements for the MEH system will thus have a supportive rather than a direct role in the operation of navigational aids and safety facilities and mechanisms (e.g., VTS, DGPS and AIS stations, etc.). The maintenance and operation of these facilities and associated

equipment will remain a responsibility of the existing agencies. In this way, the safety of navigation in the Straits will not be compromised.

The MEH Data Centre (MDC) will be the core MEH institution. It will be established under a cooperative agreement among the three littoral States, and will manage and operate the technical components of the MEH system, i.e., the data and information on environmental monitoring and emergency response and those related to navigation safety, such as hydrographic data and ENCs. The main function of the MDC will be to transform the exisiting marine information databases into a common working format and process the data into specific products, then package and disseminate them to the MEH users.

Subdidiary MDCs will be established in each littoral State, which will function as the national data clearinghouses. The three national servers will be linked through high-speed digital connection, such as the Integrated Services Digital Network (ISDN) line, via a virtual private network (VPN). The ISDN is a digital telecommunications network that is able to carry voice, data, image and video, while VPN uses a public network, such as the Internet, to link up with remote systems in a secure and private channel. The network management of the MEH system covering policy, staffing, platform, administration, maintenance and security (e.g., virus, worms) will be developed as part of the establishment of the MDCs.

Effective linkages between the MEH system and the related national authorities will be established. This is vital for its effective operation, because the national authorities will be the primary producers of the marine information that the MEH will package and supply. Thus, co-operative agreements, including operational modalities, guidelines and protocols, will be established between the MEH corporate body and these authorities in order to ensure the smooth operation of the MEH.

The activities under this component that will develop these institutional and operational arrangements comprise:

1. Development of the operational and administrative mechanisms in the littoral States to establish the MEH system.

This activity will assess various alternative operational and administrative mechanisms for the establishment and operation of the MEH system and establish the most appropriate administrative mechanism. It will take into account existing co-operative arrangements and the national, regional and international bodies that deal with various issues and aspects of marine management in the Malacca Straits, including the Steering Committee of the MEH Project. It will also design the various components of the managing unit, including its terms of reference, corporate policies and regulations.

2. Organization and management of MEH system digital data exchange and warehousing.

Mechanisms will be established to ensure the reliability of the MEH system, the smooth flow of information, including access and quality control, define the roles and responsibilities of data and

service providers, and the overall management and maintenance of the system. This activity will also determine the MEH network management, administration, maintenance, policy and computer security, including telecommunications networking, and will establish the MEH Data Centres, taking into consideration existing national and regional capacity.

Project Component 4 - US$0.18 million

Component 4: Evaluate the financial, social and economic benefits of the MEH system and promote its sustainable financing through a public-private partnership.

The costs of installing, maintaining, managing and enhancing their maritime safety facilities and measures are financially taxing to the littoral States. Compensation for the costs that the littoral States have incurred for the Straits cannot be realized as international law prohibits them to charge for a toll or other fee merely for passage through the Straits (Article 26 of 1982 UNCLOS). However, if the MEH is to be financially viable, a means must be found to cover its operating and future investment costs. The UNCLOS does allow a coastal State to charge for specific services rendered to a ship on a voluntary basis. The type of charges and the manner of charges, however, are not specified. The demonstration project will explore various cost-recovery options for the system and propose a mechanism through which it could be made financially viable and sustainable.

It is envisaged that the revenues from voluntary subscriptions to the MEH system, its products and services will flow into a "MEH Fund" that will be developed and managed within a public/private partnership framework under the project. Part of the revenue from the MEH system will then be used to cover the future operation, administration and management costs of the MEH system, including its maintenance and upgrading. A percentage of the revenue will also be used for coastal environmental protection and management purposes, particularly on chemical and oil pollution prevention and remediation. This latter mechanism will constitute an Environmental Trust Fund subset of the MEH Fund.

This component will identify the most appropriate financing mechanism for the MEH, based on inputs from the relevant stakeholders, and will estimate the financial, social and economic benefits that would result from the establishment and operation of a full-scale MEH system for the entire Straits of Malacca and Singapore. Article 43 of 1982 UNCLOS and relevant international conventions, protocols and agreements will be considered in the formulation and validation of the financial plan. The activities to be completed under this component are:

1. Socio-economic assessment of the MEH system.

The MEH system is expected to generate significant societal and economic benefits, particularly for the three littoral States and the ship owners whose vessels use it. This activity will assess the cost as well as the benefits that accrued from the establishment and use of the MEH system in terms of enhanced maritime safety and marine environment protection. This activity 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.

2. Financial assessment of the MEH system.

This activity will assess the potential financial viability of the MEH system (infrastructure, operation and management) as well as conduct a market analysis for potential users (e.g., willingness to pay). The activity will also look into the value-added and various modalities of revenue generation. On the environmental aspects, the financial assessment will tackle the financial benefits associated with the integration of environmental systems covered by Component 2 in conjunction with Component 4, activity 5 and 6 below.

3. Evaluation of the financing mechanisms for the MEH system.

This activity will evaluate various sustainable financial mechanisms and outline the mechanisms needed to establish the full-scale MEH system, such as Trust Funds, public-private partnerships, among others including cost-benefit of the demonstration system, the modalities of revenue generation and management, co-financing of the full-scale system, and agreements among stakeholders on the funding and financing the system. This activity will also evaluate various practical mechanisms to implement Article 43 of the 1982 UNCLOS.

4. Promote financing of the MEH system through public-private partnerships.

This activity ties in with the previous two activities and focuses on identification of partners for the full-scale MEH system, modalities to secure their participation and commitments. This activity also covers the strengthening of partnerships among existing stakeholders committed to the implementation of the demonstration system. International conferences will be organized with the participation of relevant stakeholders (user States, private sector, littoral States, others) to address the financial sustainability of the MEH system within the context of Article 43 of the 1982 UNCLOS.

5. Packaging the MEH system technology and essential marine information as an investment project.

This activity focuses on marketing strategies to package and market the MEH system and the essential marine information it carries and the services it could provide, to draw in potential users and partners, especially those who are dealing with coastal management, marine environment management, certain NGOs, and user States including relevant entities outside the 3 littoral States.

6. Cost-benefit evaluation on system integration of maritime safety and marine environment protection technologies and information.

The MEH demonstration system will be subjected to cost-benefit analysis to determine the value-added in terms of facilities, services, information and operations. This activity will be undertaken in conjunction with activity 2 and 5 of Component 4. The expected outcomes will lead to the development of mechanisms to generate revenue for the MEH system and also the development of strategies and actions to promote the wider usage of the system other than the

existing stakeholders.

Project Component 5 - US$0.18 million

Component 5: Promote awareness and participation of relevant stakeholders to support the MEH system.

This component will promote the benefits and applicability of the MEH system to broaden awareness and acceptance of it. Effective promotion of the MEH system at the demonstration phase is envisaged to attract donors to finance the implementation of the full-scale MEH Project and is expected to have a multiplier effect among relevant stakeholders, especially those from the user States. The activities under this component are:

1. Organization of national and regional workshops and special seminars on the benefits and applicability of the MEH system and users feedback.

This activity will deal with the preparation and organization of regional workshops and special seminars on the dissemination of information about the MEH system and the demonstration Project in general. This activity will focus on enhancing awareness on the benefits and utility of the MEH system and as means to broaden client base including dialogue with users to ensure improvement of the system and effectiveness on the delivery of products and services.

2. Production and dissemination of information on the MEH system through print media and via the Internet.

This activity will involve the preparation, production and dissemination of project outputs such as technical reports, progress reports and a newsletter as well as on the MEH products and services using printed media, video and the Internet.

Project Component 6 - US$2.49 million

Component 6: Strengthen national and regional capacities in maritime safety and marine environment protection for the sustainable management of the MEH system.

This component will strengthen the national and regional capacities for the operation and management the MEH system in addition to their existing duties and responsibilities. This component will provide the means to move towards digital technology through training to effect the necessary institutional and management changes to sustain the operation of the MEH system. The initiation of technical training of in-country and regional personnel during the demonstration project is envisaged to develop a pool of dedicated technical staff to operate and maintain the system over the long term and at the same time, able to move forward with new or emerging needs and technologies. The activities under this component are:

1. Organization of regional training on the operation and management of the MEH system.

To ensure that the MEH system is effective and efficient, competent staff must handle its operation and maintenance. This activity will focus on capacity building for the MEH system covering technical backstopping at the regional level. National staff assigned to the project's

MDCs will undergo training with a regional focus so that they will be able to appreciate and understand the operation and maintenance of the system in a regional context as well as the interdependency of the system. This aims to create accountability among MDC staff as well as improve operational efficiency.

2. Organization of specialized short-term trainings on various components of the MEH system covering data processing, maintenance, field validation, troubleshooting and communications.

This activity is similar to the regional training although more focused on specific components of the MEH system such as data collection and validation, processing and production of ENCs, troubleshooting and network management. Such specialized trainings will be have one day to 1 week duration.

Project Component 7 - US$0.10 million

Component 7: Plan the transition to the full-scale MEH project and assess the feasibility of establishing the second phase MEH system covering the Straits to the Sea of Japan/East Sea.

The second phase MEH system is envisaged to cover priority waters between the Straits to the Sea of Japan/East Sea. Compare to the Straits, this sea area is large and covers several East Asian countries, some of which are major users of the Straits. Focus of the feasibility study will be on areas that are critical to international shipping such as precautionary areas and where incidents of oil spills are deemed high. Replicability and link up with such program as the Singapore, Hong Kong Admiralty Raster and ENC Demonstration (SHARED) to cover parts of South China Sea will be explored.

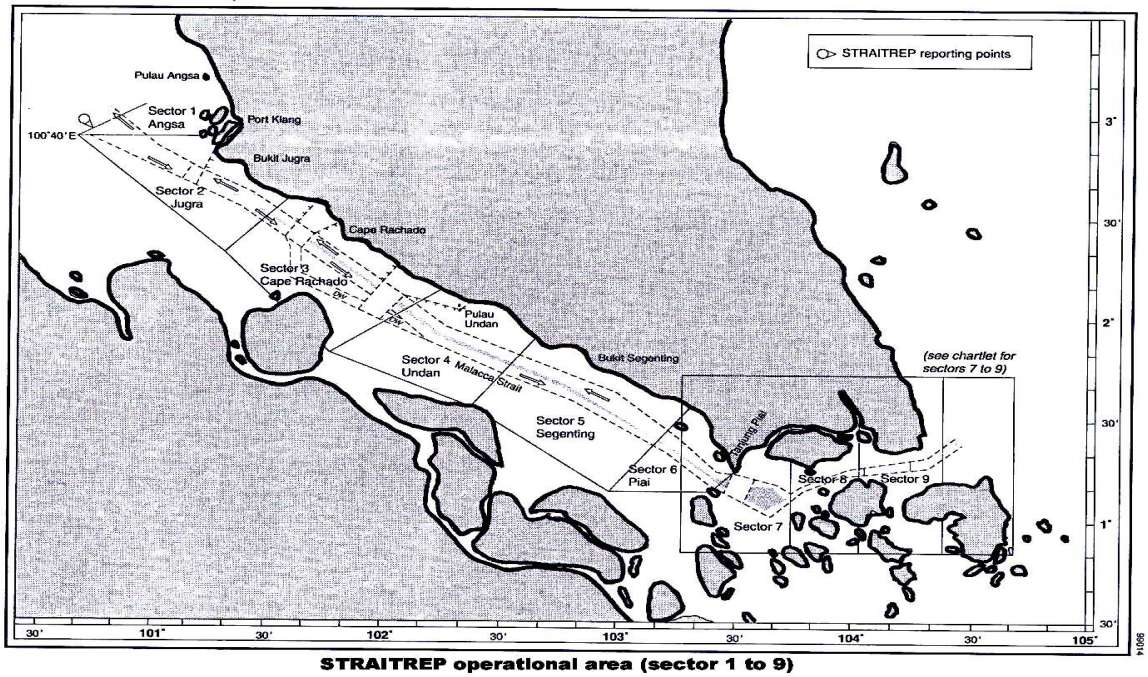
In addition to assessing the feasibility of establishing a second phase MEH system, this component will also cover the transitional activities for the development of the full-scale MEH Project.

1. Transitional activities for the development of the full-scale MEH Project.

This activity will evaluate the initiatives undertaken during the demonstration phase that will have direct bearing on the implementation of the full-scale MEH Project such as financial and institutional arrangements including the development of the managing tool, mobilization of resources and the preparation of project proposal. Extensive consultation with the littoral States and other relevant stakeholders will be made through meetings and workshops in conjunction with the implementation of the various activities of the demonstration phase.

2. Feasibility of establishing a second phase MEH system.

This activity will involve a preliminary economic, market and financial feasibility of establishing a second phase covering priority waters for international voyages from the Straits to the Sea of Japan/East Sea. Also, a regional forum will be organized to determine the acceptability of a second phase among relevant potential stakeholders of the East Asian Seas region.



STRAITREP operational area (sector 1 to 9)

Additional GEF Annex 3: Incremental Cost Analysis
EAST ASIA AND PACIFIC: 4E-Marine Electronic Highway

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 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 GT) called at the port of Singapore. Vessel arrivals from 1995 to 2001 increased by an average 6.% per year for the Port of Singapore and 11% 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% 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% (± 0.03=95%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 'Singapora Timur' (May 2001). Total compensation claims for the 'Natuna Sea' from the 3 littoral States were over US$127 million, but only 8.48% was paid due to unsubstantiated and disallowed claims, especially on environmental and fishery-related damage.

5. Although the three littoral States of Indonesia, Malaysia and 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 Indonesia, Malaysia and 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 UNCLOS and 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 VHF 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 VHF 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 TSS. 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, allision 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 100km 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 their shipping and environment management institutions.

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 marine 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 for the MEH, 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 electronic navigation and environmental information technologies to enhance marine transport through and environmental management of the Straits of Malacca and Singapore.

2. Development of appropriate nstitutional arrangements for the installation and operation of the MEH 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 economic and environmental 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 the full-scale system's financial feasibility.

4. If the conclusions of the economic and environment and the financial feasibility analyses are 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 design, finance, construct and operate the full-scale 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 install a Marine Electronic Highway (MEH) system in the Straits of Malacca and Singapore. The project's primary objective is to demonstrate, by establishing a MEH demonstration system in the narrowest and most congested

100km 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. A secondary project objective is to strengthen coastal and marine resource management by providing better information on ship-related environmental threats and promoting collaboration between the littoral states' national marine and environment institutions in coastal and marine environmental management.

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 coastal and 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, 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 $16.2 million. Of this, ship owners and operators will fund about $5 million for the ship-based equipment required to utilize the MEH; Indonesia, Singapore and Malaysia will fund about $3.2 million of investment in upgraded shore facilities to supply the additional real-time information the MEH requires; and the GEF is requested to fund the balance of $8 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
Integration of existing, standard marine navigation and environment systems in the Straits of Malacca and Singapore into a Marine Electronic Highway System	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.	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.	Significantly imroved safety margin for vessel operations. Increase in operational efficiencies of vessels. Reduced incidence and risk of collisions, possibly leading to lower insurance premiums. Lower oil spill response and clean-up costs. Improved quality and availability of marine environment information. Improve management of vessel port arrivals/departures. Effective interactive tracking and monitoring of vessel movement by the VTS. Greater use of local port facilities and services. Reduce congestion and more efficient vessel traffic management, including cross-Straits traffic.	Less environment-related damage in the Straits of Malacca and Singapore due to improved navigational safety. Lower fuel ship consumption and greenhouse gas emissions. Accessibility and exchange of marine environmental information at any time at low cost facilitates better conservation. Enhanced monitoring and forecasting of oceanographic, meteorological and environmental conditions of the Straits, including biodiversity mitigates impact of shipping accidents. Better oil spill detection, prediction and more effective response results in less environmental damage from spills that do occur. Improved compliance with marine environment conventions and standards.
Production of electronic charts for the MEH system's 100km section of the Straits.	Small scale ENCs from the Four Nations Joint Survey covering the international sea lanes of the Straits have been completed but not yet released or used. Little use will be made of them due to their modest quality and limited coverage.	Production of high resolution ENCs for the Straits will have a pivotal role in the adoption of new and emerging maritime technologies to 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 mode, particularly useful for marine emergency response and maritime security.	Same as above	Same as above

Component	Baseline	Alternative	Domestic Benefits	Global/Regional Benefits
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 institutional arrangements that include the private sector.	Same as above	Same as above
Integration and enhancement of regional marine environment protection systems within the MEH framework	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. Environmental monitoring in the Straits is generally undertaken on an *ad hoc* basis, including collection of hydrographic and oceanographic data. Applications of environmental data in the Straits are limited, particularly on transboundary issues, including pollution response, due technical and resources limitations.	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 Through information and communication technology (ICT), continuous and real time environmental monitoring is achieved, ensuring reliable and accurate assessments and forecasts. Availability of sea-based monitoring devices for hydrographic and oceanographic parameters with telemetry capability significantly enhance monitoring programs and the use of environmental data for policy and management decisions.	Reduced risk of shipping accidents (groundings and collisions) in ports and congested sea lanes and better port manoeuvres. Increased cargo load due to better definition of under keel clearance with updated and precise bottom soundings. Reduced damage claims associated with oil spills. Reduce queuing time for vessels at entering the TSS or ports. Better usage of port facilities. Reduce red tape in data acquisition, delivery and access.	Enhanced regional and international cooperation to mitigate transboundary marine pollution issues leading to less environmental damage. Promotion of sustainable resource use. Improved emergency response (search and rescue, pollution response) reduces negative regional environmental impacts of ship accidents or pollution releases. Model of marine environmental information management and collaborative response for other sea areas in the world, especially along congested and busy waterways.
Evaluation of the economic, social and evironmental 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.	International partners - the GEF, Japan and the World Bank, contribute to and learn from the evaluation. This enhances their ownership of it and, if is positive, promotes support for the second phase MEH and achievement of its global environment benefits.
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 feasibile 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.

Additional GEF Annex 4: STAP Roster Technical Review
EAST ASIA AND PACIFIC: 4E-Marine Electronic Highway

Scientific and Technical Review
By Professor Richard Goss, Master Mariner

Technical Soundness

The demonstration project will not introduce any new technology but will make maximum use of that currently available. In doing this, there are a few operational aspects that should be given more attention

a. ECDIS and other ship-borne equipment

The ship-borne equipment which results from this study will have to be used by ship-borne people and I therefore wonder at the absence of specialist navigation and nautical bodies from the list of those advising. You will appreciate that current ship-borne people are not always adequately represented either by associations of their employers or by former seafarers whose practical experience ended some time ago -such as myself -even if they still use the title of Captain.

May I suggest contacting Mr. Julian Parker, Secretary, The Nautical Institute, 202 Lambeth Road, LONDON SE I 7LQ and Group Capt D W Broughton, MBE, Director, The Royal Institute of Navigation, 1, Kensington Gore, LONDON SW7 2AT. Both are highly respectable professional institutions with worldwide -not just British -memberships and IMO accreditation. Prince Philip is an Hon. Fellow of the first and Patron of the second. The Royal Institute of Navigation benefits from a strong air navigation component and the Nautical Institute from extensive contacts with people serving at sea.

Singapore, however, has its own Nautical Institute and you might care to contact them directly. I also wonder at the absence of academic contacts, for there are many universities around the world with developed maritime interests, economic and environmental. Some of their staff have practical sea-going experience. If you want a list, with named contacts, I could supply it.

b. How to deal with small ships

S E Asia has many ports, often with small throughputs, and much trade is carried over short distances, so optimal ship size is small. Moreover, many of these vessels are traditional, built of wood and correspondingly make poor radar targets. Practical problems must therefore be expected and this may not be wholly related to the familiarity of mariners with the reporting requirement. Greater problems may be expected with fishing vessels and those of the less reputable registers. See, for example the Port State Control reports on ships without compasses, inoperable life-saving and fire-fighting equipment and (paper) charts. Some aspects of this are referred to on p 81. The Malacca Straits are also a notorious center for piracy and I am surprised

that this is not covered -though the RIBs commonly employed for piratical purposes are, of course, poor radar targets.

c. Under-keel clearances

Precise use of under-keel clearance may indeed depend on new and repeated bottom surveys: also new and more precise information on tides and surges, e.g. those caused by winds and changes in barometric pressures These are far from trivial matters (i.e. for any given under-keel clearance, maximum drafts will vary from time to time) and deserve consideration if expectations are not to be followed by disillusionment.

If ECDIS is to be trusted with respect to such matters (as optimum under keel clearance and precise position-finding) then the hydrographic authorities must be prepared to drop the restrictive wording they commonly employ (e.g. "no guarantee can be given") and accept legal responsibility for the information they provide. I have seen no sign that this has been appreciated, let alone accepted. Yet, if this is not done, the MEH will not be sustainable or replicable.

d. Ship operations

Seaways, the Nautical Institute publication, carries many examples of ships not being operated 'credibly', e.g. without lookouts, failing to answer signals and without regard for the collision regulations. However, the demonstration project as described in the PAD, assumes that what is supposed to happen, will actually occur. Too many practical seafarers know otherwise. They often regard such schemes with skepticism, especially about the possibilities of achieving universal compliance.

e. Climate data

Climatic data will be needed from the off-shore buoys. Sea levels vary, sometimes significantly with barometric pressures and wind effects as well as tides.

Innovativeness

a. Charging system

Capital and operating cost estimates are described and it is *assumed* that the latter will be recovered by a charge on ships transiting the Malacca Straits This is an innovative proposal (and, as far as I know, a precedent for international waters) and both the principle involved (elements of 'public goods') and the practical means of collection (through AIS? but this has previously been considered as a safety measure, not an opportunity for collecting revenue) deserve a good deal of discussion. What about cross-Straits, e.g. ferry, traffic? Would there be any reduction for frequent users? Upon what basis would ships be charged? How would non-payers be stopped or punished? There arc economic and practical matters to be considered here, not just the legal ones as described in the PAD.

Moreover, the PAD specifies that the charges should be 'voluntary' and leaves open the question

of those who decline to pay (the 'free-riders').

Benefits

Method of evaluation

There is little discussion of the more difficult parts of the proposed cost benefit analysis (CBA) of the outcome of the demonstration project, e.g. the environmental effects. I am not aware of any accepted techniques or evaluations for assessing the benefits of avoiding marine pollution; though this is certainly no reason for not attempting to pursue the subject as far as possible. In particular we may note that avoiding the cost of clearing up the mess is likely to be a serious under-statement of the benefits of avoiding an oil-spill; the same goes for other forms of pollution. However, we should also note that CBA is, at best, an *aid* to decision-making: we should not expect it to take decisions for us.

We should, therefore, go *as far as we can* in the qualitative. quantitative and evaluation stages without necessarily expecting to do everything. Given the progress that has been made in the last 50 years (most of which I have spent arguing for this kind of rational decision-making), we may expect substantial progress to be made in the next 50.

Nowhere have I seen any outline of how this is to be done, not even a list of items to be included, let alone anything on how they are to be assessed. In considering the benefits they could be categorized as:

1 Those which reduce the social cost (including externalities like pollution) of sea transport;
2 Those which reduce the transit time of sea transport; and
3 Those which reduce the risks of sea transport (to people, ships, cargoes and the shore).

You will know that the sum of these is known as *generalized transport cost* and, whilst it is a useful concept (e.g. in providing an intellectual framework for MER), very little serious work has been done on it. Has the World Bank considered bringing in any academic economists (or **PhD** students) with a view to developing the idea in a maritime context? Do bear in mind that such economic research is extremely cheap, and especially if you use people who are already being paid by someone else.

Now is the time that some thought be given to the evaluation methodology, otherwise I do not see how the CBA is to be carried out effectively and on time. For example, how will the expected reduction in congestion in the Straits be assessed? With the use of congestion theory and the standard concept of a backward-bending supply curve? This needs to be explored so that people are ready to switch on to the relevant. techniques. Again, many of the domestic and global benefits specified here could be divided into the three elements of generalized transport cost listed above.

Obviously, the most difficult parts would be those concerning environmental effects but I imagine that WB and GEF have done relevant work in that field. Others would include

reductions in:

1. Lives lost
2. People injured, seriously and minor
3. Ships lost
4. Ships damaged, seriously and minor (including loss of time whilst being repaired)
5. Cargoes lost
6. Cargoes delayed, seriously and minor
7. Cargoes delayed
8. SAR costs
9. Port and other fixed shore installations
10. Floating navigation marks.

Use of insurance as a measure of value and interest rate as a time value

You should not suppose that social risks are in any way equivalent to insurance and for three reasons: Insurance policies always exclude some risks; they arc subject to 'deductibles', equivalent to a *de minimus* rule; and there are no insurance policies which cover delays to ships or cargo.

Taking the rate of interest on the value of the goods is a very inadequate measure of the values of time-saving. Some Belgian work suggests that it should be about seven *times* as much.

The PAD says very little about how competition in the provision of MEH type services might be encouraged. Yet it is competition which keeps the private sector efficient -and some parts of the public sector This needs to be thought. through.

Benefits derived from increases in operating efficiency would include:

1. Maintaining speed more efficiently in adverse conditions
2. Steering a more accurate course (e.g. great circle instead of rhumb line) 3. Carrying more cargo by optimizing under-keel clearance
4. Manoeuvring more efficiently when near tugs and port installations
5. More efficient implementation *of* collision regulations.

In my experience many of these present significant difficulties in respect of qualitative and quantitative assessment as well as in evaluation. If you want me to expand these ideas, let me know.

Given the successful development of Formal Safety Assessment at IMO and their welcome involvement in this work, I would imagine that you would want to use, rather than to duplicate, their ideas and practices. If you were visiting them in London then it would usually be practicable for me to attend any meetings you had with them.

Valuation of reduced risk of loss of life

The PAD makes no mention of evaluating the reduced risk of loss of human lives. It may be difficult, but IMO is making substantial progress in this field, through Formal Safety Assessment (FSA), most recently on bulk carriers. Progress is also being made in the assessment of environmental effects; but I assume GEF have relevant expertise there.

Institutional Structure

It is important that the experts in the various levels of management of the demonstration project (The Project Steering Committee (PSC), the members of the Technical Committees (TCs) and the Working Groups (WGs) as well as staff of the Project Management Office (PMO)) should work together and should be aware of each other's needs. In particular they should be aware of the need for their work to feed into the CBA through the three stages of qualitative and quantitative analyses leading to evaluation. It should be made clear to all participants from the outset, and in particular the staff of the PMO that CBA will play a major role in assessing the outcome of the demonstration project. If this is not done then much effort may be spent in work leading to unhelpful results. Statistics of gross tonnages are an example. The addition of like and unlike figures, as in some of the data already presented to the PSC, is an example.

Stakeholder Involvement and sustainability

Sustainability of the project and conversion of the demonstration to the full-scale phase depend critically on stakeholder involvement. There has been extensive and productive consultation with the national stakeholders and the major shipping users of the Straits. The proposals for consultation, and particular that with ship operators and their representatives, should be expanded. If the ship operators are not fully supportive of the actions taken during the demonstration project and the proposals for expanding them into the full-scale project, neither project will be sustainable

Replication Potential

The PAD very reasonably says that this MEH work can provide a global approach in the marine environmental sector. Indeed it may, and also in respect of ECDIS, SAR arrangements, marine surveying and many other factors. This work is, in other words, creating a precedent in many fields of which environmental assessment is only one. As such it would be worthy of support even if it did not appear (on Canadian Coast Guard CBA and CSL evidence) to be thoroughly worth-while in itself. The changes likely to be wrought in many parts of the world (Dover Straits and the inland Sea of Japan) both leap to mind, as well as the sea route from Singapore to Japan, may be as profound as those which appeared after the publication of paper charts derived from professional surveys in the late 18th and early 19th centuries or the comprehensive analyses of wind systems derived from US Navy work in the middle of the 19th century. I think the terms in which the expansion of the demonstration to the full scale project are too modest and the rate of progress too slow. (These points are taken up on p 5 of the Draft Project Brief for the GEF, see below.)

Charging mechanisms for this MEH have implications for other places. Many of the lights and buoys of the UK and Ireland are currently financed through a hypothecated tax charged on ships entering the ports. The many ships which steam past pay nothing; nor do they contribute anything to the costs of the elaborate UK-French regulation of navigation in the Dover Straits (radio micro-wave links, VHF navigation advice, ship identification by aircraft). This situation is currently controversial and precedents are therefore correspondingly important.

World Bank Response to the Scientific and Technical Review

The very constructive comments of the Reviewer have proved helpful in considering how the project design and implementation can be adapted to increase the probability of success. The project team looks forward to a continued active involvement of the Reviewer in assessing progress and modifying the demonstration project as necessary during its implementation.

Technical Soundness

a. ECDIS and other ship-borne equipment

The recommendation of the Reviewer is accepted and his sources will be contacted for a maritime advisor. To date, the extensive stakeholder consultations with representatives of shipping lines using the Straits have provided an indirect perspective of ship Captains, but a more direct advisory role will be incorporated into the demonstration project.

b. How to deal with small ships

Small ship operators will not be able to afford the ECDIS equipment proposed for the project. Design of the ECDIS systems and their incorporation with standard navigation systems will be deigned to maximize the possibility of detecting small ships.

c. Under-keel clearances

Minimizing under keel clearances is one of the benefits that would make the full-scale MEH attractive to ship operators. The IHO is an active participant in the project management (a letter of commitment has been received from them). However, we accept the reviewers' comment on the need to pay particular attention to the legal repercussions of providing more detailed information of changes in channel depths than is usually available.

d. Ship operations

The advice on "not credible" ship operations is noted and methods of dealing with issue will be sought from the ship operating advisors chosen under (a) above.

Innovativeness

a. Charging system

The details of the charging system will determine the acceptability of the full-scale scheme to the ship operators and be designed to provide adequate revenue to the operator of the MEH to cover investment, system and data maintenance and operating costs. At the same time since the MEH will operate in international waters if will of necessity be voluntary. The charges should be set so that sufficient ship operators see a financial benefit to participating in the scheme. The Reviewers observation that satisfying these needs will be difficult is recognized and much of the technical effort in the last two years of the demonstration project will be devoted to devising a sustainable financing system.

Benefits

Method of evaluation

It is recognized that little progress has been made to date on establishing the methodology of the evaluation of the demonstration project. The recommendations of the Reviewer are accepted and welcomed and will be acted on in the design of the evaluation method. The Reviewers advice will be sought on suitable advisors to the Project Team on how the evaluation should be done, and particular on the data that will need to be collected early in the demonstration phase to provide the “base case” for comparison with that after implementation.

Institutional Structure

Most, if not all, the participants in the various levels of administration of the demonstration project are experienced in management of projects involving shipping in international waters. They are aware of the need for a high level of coordination and collaboration. In selecting the members of the PMO, the IMO and GEF Task Manager will take full account of the advice of the Reviewer in this respect.

Stakeholder Involvement and sustainability

The IMO and Project team have been cognizant of the need for an exceptionally high level of stakeholder involvement. Frequent coordination meetings have been held in the participating countries at which all major stakeholder interests, including shipping operators and potential providers of services and equipment to the demonstration project have participated. An indication of the success of this coordination and the strength of ship-owner participation is their commitment to equip sufficient ships (a minimum of 60) with the equipment necessary for the demonstration project to function. It is expected that the interest of other ship-owners shown so far will result in their also equipping some of their ships to take part in the demonstration project.

Replication Potential

The IMO is participating in other projects that are intended to replicate at least in part some of the components of the demonstration project. The EU and maritime agencies of several European

governments and of Japan have expressed an interest in being kept informed of progress on implementation of the demonstration project. The project work plan envisages a lengthy process of discussion with these and other maritime agencies (including those of the US and Canada) to ensure that lessons of previous attempts at establishing MEH-type systems are fully taken into account in the design of the full-system and to ensure so far as is possible that it will be compatible with other systems being considered.