PROGRESS UPDATE AND FUTURE DIRECTIONS OF THE MARINE ELECTRONIC HIGHWAY (MEH)

BACKGROUND

1. The Marine Electronic Highway Demonstration Project (MEH DP) was a 4-year regional project in the Straits of Malacca and Singapore (SOMS). Its overall objectives were to enhance navigational safety and security, and promoting marine environment protection and the sustainable development and use of the coastal and marine resources of the littoral States of Indonesia, Malaysia and Singapore.

2. In September 2005, Agreements were signed in Jakarta, Indonesia between the Global Environment Facility (GEF)/World Bank and the Signatories which include the three littoral States, IMO, the International Hydrographic Organization (IHO), the International Association of Independent Tanker Owners (INTERTANKO) and the International Chamber of Shipping (ICS) to co-operate and collaborate to implement the MEH Project.

3. The MEH DP activities included :

   a. Conduct hydrographic survey using multi-beam technology, with the aim of producing electronic navigational charts (ENCs) covering the Traffic Separation Scheme (TSS) of the SOMS Routing System from One Fathom Bank to Pulau Iyu Kecil;

   b. Establish links between shore-based marine information and navigational equipment onboard transiting ships, including incorporation of marine environmental management systems.

4. With the 2005 agreements in place, on 19 June 2006, the (GEF)/World Bank and the International Maritime Organization (IMO) signed an agreement providing a grant of US$6.86 million for the implementation of the project.

5. Subsequently, in 2006, the Republic of Korea also provided funding support, in particular, to help finance the procurement and installation some equipment and systems for the Batam Data Centre which consolidates the marine environmental data in near real-time.

PROJECT DESCRIPTION

6. The MEH DP was phased as follows:

A) Site Selection

7. The SOMS was selected for the MEH DP for the following reasons:

- It is a major shipping route where it is shortest and preferred shipping route between the Indian Ocean and the South China Sea. Many oil tankers ply this route between the Persian Gulf and East Asia.
- It is shallow, with narrow channels, irregular tides (semi-diurnal tides) and has a shifting seabed topography, which can pose hazards to navigation.
- It is rich in natural resources on which many of the coastal inhabitants depend and which are vulnerable to the impact of oil spills and other discharges from ships.

8. The SOMS is one of the busiest waterways in the world and in 2011 more than 73,000 ships passed through the TSS that forms a major part of the Straits. This total included more than 4,500 Very Large Crude Carriers (VLCCs) and 5,500 deep draught (more than 15m) container ships. There is also much cross-Strait vessel traffic which cuts through the major shipping lanes and is a major contributor to collisions and other incidents.

9. The project area covered waters about 600 km in length from One Fathom Bank in the Malacca Strait to Horsburgh Lighthouse at the eastern entrance to the Singapore Strait, as shown below:

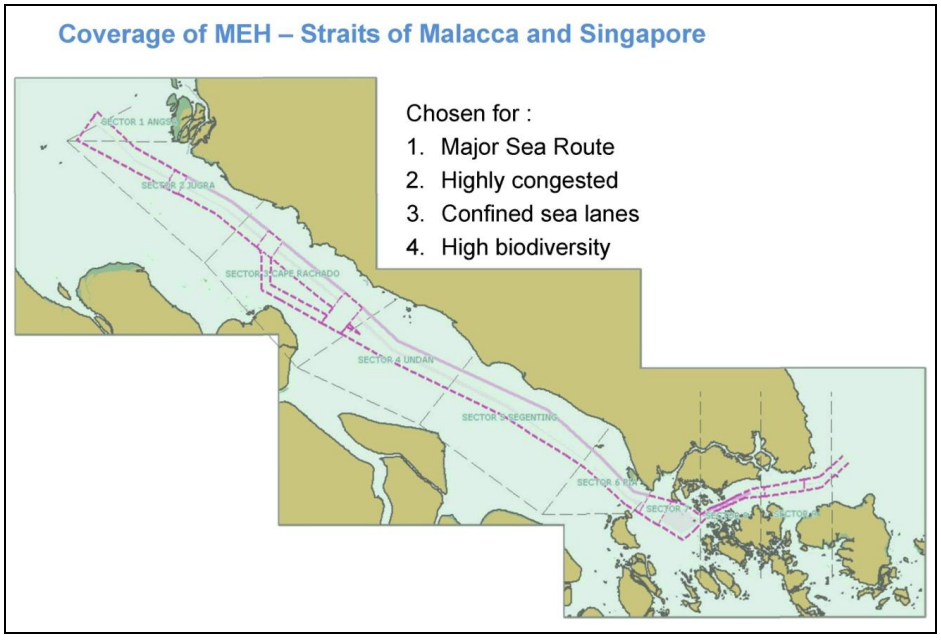

Fig 1: Area coverage of the MEH DP.

B) Establishment of the System Infrastructure

ECDIS – The Core for Integration with Real-time Sensors

10. The MEH DP was designed to integrate new and proven marine navigation technologies to help further improve navigational safety and protect the marine environment. It was envisioned that the MEH would be a coordinated regional network of real-time marine information technologies integrated to the shipboard Electronic Chart Display and Information System (ECDIS). It was recognised early on that ECDIS with ENCs would form the core of the geographical information database system which would be integrated with the various sensors, including Differential Global Positioning System (DGPS) and tidal data, to further enhance navigational safety in the busy and confined waters of the SOMS.

11. To establish communications between ship-to-ship and ship-to-shore and vice-versa, the Automated Identification System (AIS) technology was selected to be integrated with ECDIS. The benefits of using AIS as a communication platform was twofold: firstly, it provides the exchange of information of passing vessels and with shore based stations; secondly, it displays AIS targets/symbols on ECDIS. This provides the mariner a clear and consolidated picture of the location of navigational hazards and environmentally sensitive areas when taking collision or grounding avoidance action.

Providing High-Resolution ENCs

12. The MEH DP also incorporated a hydrographic survey component covering selected areas measuring 621 square km around One Fathom Bank. The objective of the survey was to cover the area, which has sand waves, with a high-resolution multibeam survey. The initial proposal was to survey area the entire Malacca Strait but this had to be reduced primarily due to funding constraints. On completion of the survey, unfortunately the results of the hydrographic surveys could not be used for nautical charting due to the lack of tidal information to accurately determine the seabed topography. The only outputs of the survey results we managed to salvage was information used to confirm the positions of existing wrecks and identify new wrecks.

13. The hydrographic survey result was supposedly to be used to support one of the other original objectives of sand wave studies. However, due to lack of funding support, this activity could not be carried out. For a proper sand wave study to be carried out, there is a need plan for regular surveys to determine the movement of the sand waves, including seasonal monsoon effects.

Provision of Real-time Tidal and Meteorological Information through the MEH Website

14. In consultation with the stakeholders, one of the key requirements developed for the MEH DP was the need for near real-time marine information such as tides, current and wind. These information would particularly be useful for the very large crude carriers (VLCCs) transiting the SOMS with drafts of up to 22 metres in the eastbound lanes of the TSS. Similarly, the information would be useful for deep draught vessels drawing 15 metres or more that are westbound. The figure below shows an example of the tidal level in real time at Tanjong Pagar, Singapore.

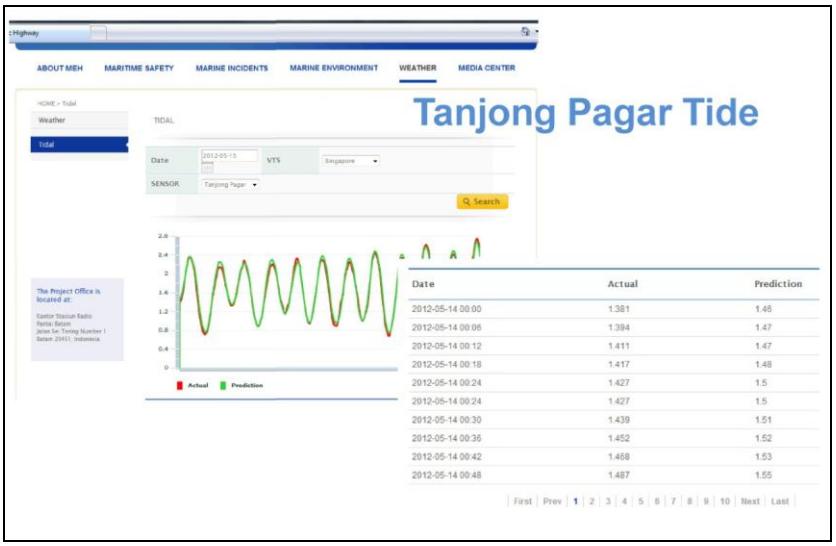

Fig 2: Near Real-time Tidal Information from one of the MEH tidal stations

15. In order to determine the usefulness of the information provided by the MEH DP, a survey was conducted for vessels passing through the SOMS. The participating ships could access the information from the MEH Website. This survey was also to ascertain the availability of the internet service as a communication link between ship and shore. Although only about 20 ships participated in the survey, the results were most enlightening as mariners found the information useful and requested for more tidal and meteorological information to be provided for the entire length of traffic separation scheme in the SOMS.

16. The tidal and meteorological information resides in the MEH Data Centre in Batam. The information is then disseminated to users through the MEH website.

Development of Environmental – Marine Information Objects (e-MIOs)

17. The MEH DP system was designed with marine environmental modules in mind. The e-MIOs are layers of geographical information that are overlaid on the ENCs. The e-MIOS could be used in marine pollution response and control such as to predict the direction and speed of oil spill and to effectively respond to the clean-up. It could also be possible to use it to identify and track ships that illegally discharge their bilges or dump other oily wastes.

18. Besides tidal and meteorological information, users were also provided with ENCs embedded with e-MIO for their comments. It was explained to the participants that the e-MIOs would be used in case of a marine accident. The information is meant to provide the ship master with the necessary information to make an informed decision on the best course of action to take during an emergency such as collision resulting in an oil spill. The master would then switch over to the mode to display the e-MIOs data against a backdrop of ENCs which highlighted environmentally sensitive areas. The master could then make an informed decision on where to anchor his ship to minimise the extent of pollution to such areas.

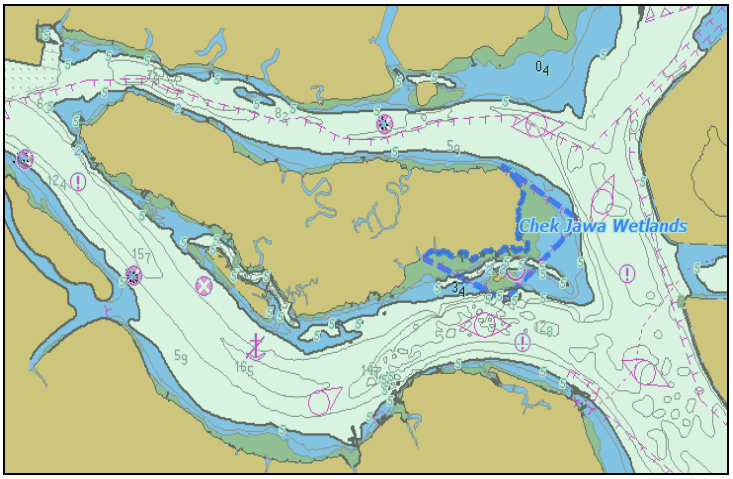

Fig 3: Sample of ENCs with e-MIO showing the marine wetlands.

System Architecture

19. From the above the inputs, the overall system architecture is shown below.

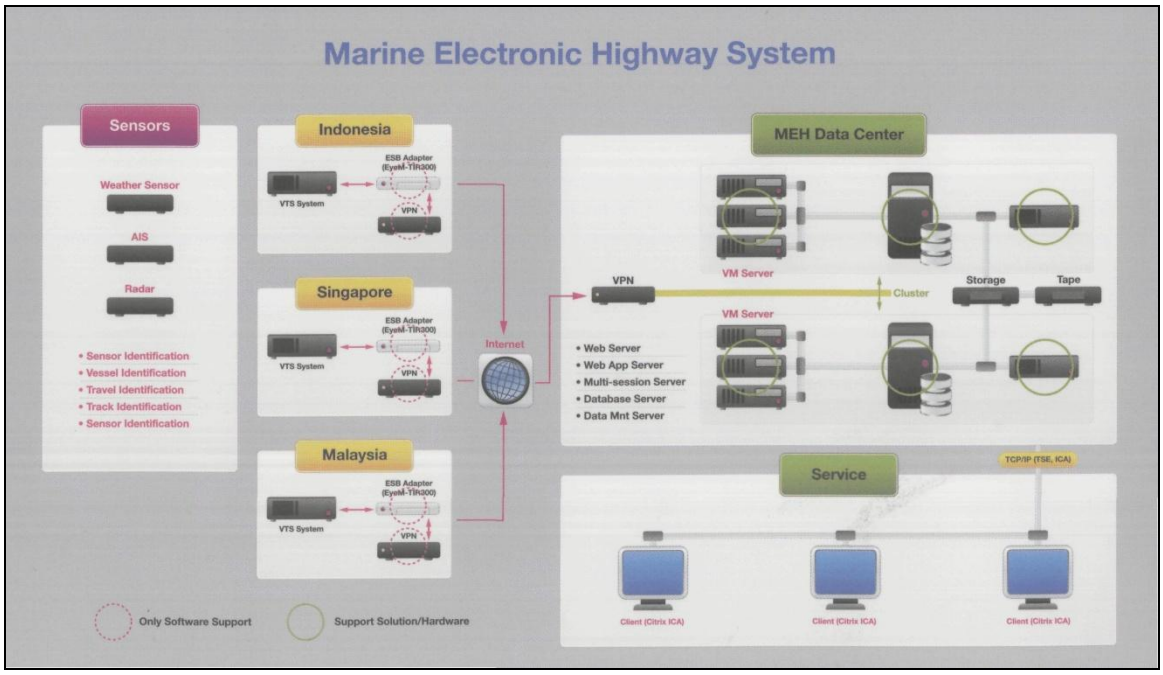

Fig 4 : MEH DP System Architecture.

MOVING FORWARD: THE MARINE ELECTRONIC HIGHWAY FOR THE STRAITS OF MALACCA AND SINGAPORE (MEH SOMS)

Incorporating the MEH SOMS Working Group under the TTEG

20. When the MEH DP officially ended in December 2012, the three littoral States recognized the potential benefits of a MEH for users and stakeholders of the SOMS. As such, the three littoral States categorically agreed to fully implement the MEH and place it under the TTEG. Therefore, in October 2012, the MEH SOMS was designated as a permanent Working Group under the TTEG, which would take over the decision-making role of the previous MEH Project Steering Committee (PSC). It is a positive step forward for the MEH, as placing the decision-making and coordinating role of the MEH under the TTEG. This would be in line with having the responsibility over the safety of navigation and environmental protection in the SOMS lie with the three littoral States.

21. In addition to the administrative and management functions of the PSC under the TTEG, the MEH would also require a means through which:

a) user States and stakeholders can provide feedback on the MEH and suggest new initiatives and technologies to be implemented;

b) the feasibility of these new initiatives and technologies can be demonstrated; and

c) access to voluntary contributions from user States and stakeholders to fund and support implemented components of the MEH (e.g. the MEH Data Centre).

22. The above requirements could be met through the components of the Co-operative Mechanism on Safety of Navigation and Environmental Protection in the Straits of Malacca and Singapore ("Co-operative Mechanism") which shares the same basic objectives of improving navigational safety and promoting marine environment protection in the SOMS. Through this relationship with the Co-operative Mechanism, the need for sustainable financing and contributions for initiatives aimed at accomplishing these basic objectives could be met.

23. The Co-operative Mechanism consists of three components which are inter-connected and complementary, namely, (i) a Co-operation Forum; (ii) a Project Co-ordination Committee; and (iii) an Aids to Navigation Fund. The TTEG is the principle co-ordinating and decision-making body of the three littoral States in the Co-operative Mechanism. The relationship between these entities is shown below:

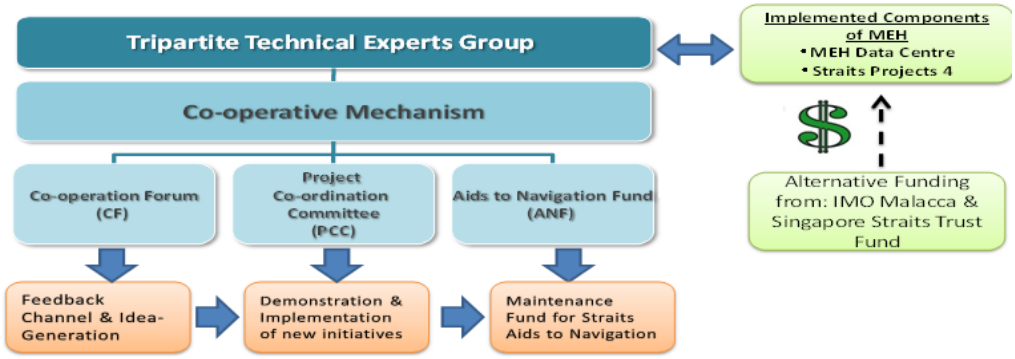

Fig 5 : Organisation chart of the TTEG and supporting bodies.

24. It is noteworthy that several projects such as current measurements and wreck removal presently under the Co-operative Mechanism could be incorporated into the MEH when completed. With the integration of these components with the MEH, there would be greater synergy and minimal duplication with regard to initiatives enhancing navigational safety and protection of the marine environment in the SOMS.

25. The functions of the Project Coordination Committee (PCC) under the Co-operative Mechanism included the means to continuously seek, identify and prioritise projects, either new or to complement existing projects. With this in mind, the PCC forms an important part of the Co-operative Mechanism to oversee the demonstration and test-bedding of initiatives and technologies with

potential application in the MEH as Straits Projects. Additionally, the PCC allows for the involvement of user States, industry and other stakeholders to contribute expertise and/or funds to these initiatives and technologies being demonstrated.

NEXT PHASE OF MEH SOMS

Integrating the MEH SOMS with IMO'S e-Navigation Initiative

26. The MEH project has shown that it could generate interest beyond the three littoral States. The successful demonstration of interface between ship- and shore-based technologies attracted the interest of the IMO Correspondence Group on e-Navigation. One of the key points was that the MEH provided an ideal framework for the adoption and integration of successful initiatives, including existing projects under the Co-operative Mechanism.

27. The IMO Correspondence Group on e-Navigation also recognized the relevance of the MEH and synergies between the MEH and e-Navigation. This created the opportunity for the testing of e-Navigation technologies and strategies under the MEH. With the synergy from both groups, there lies possibility to create a strategy that leads to reduced human error in relation to maritime accidents and to increase the efficiency of maritime transport. E-Navigation represents an opportunity to expand on the existing work already accomplished under the MEH and to profile the littoral States and the SOMS as being at the forefront of a global initiative. The MEH continues to attract user States and stakeholders from China, Japan, IMO, IHO and ICS.

28. Moreover, any initiatives and technologies which are identified as Straits Projects under the Co-operative Mechanism could also be fully realised under the MEH. Similarly, relevant components of IMO's e-Navigation initiatives could potentially have applications to the MEH. These could be formalised as official projects with contributions from interested organisations such as the IMO, IHO, IALA, ICS and member States of the IMO e-Navigation Correspondence Group (e.g. Norway, the UK).

Back-up Arrangement for the MEH Batam Data Centre Website

29. To ensure sustainability of the project and continuous availability of service to the users, the MEH Working Group had initiated several work programmes such as the back-up arrangement for the MEH Batam Data Centre. With the back-up in-place, users would not be inconvenienced with interruption in service or difficulty in accessing the MEH Website. The back-up arrangement is scheduled to be implemented in 2nd half of 2014.

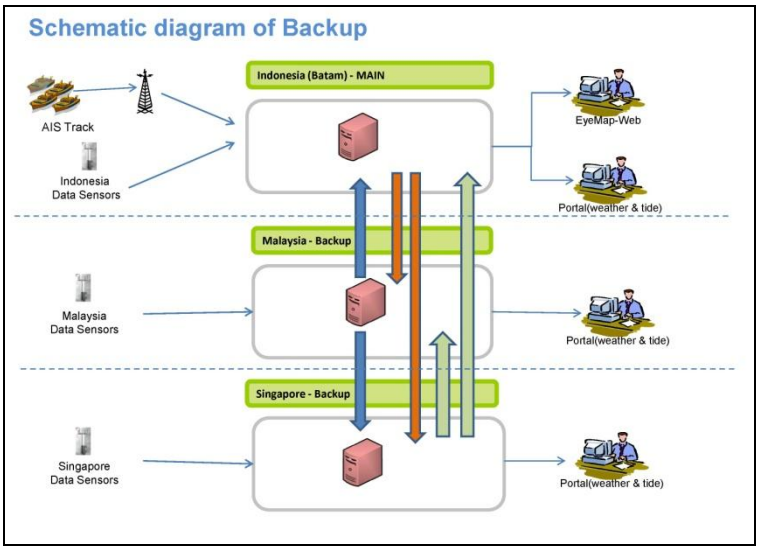

Fig 6: Schematic diagram of the back-up arrangement.

UKC Concept Study for Under-Keel-Clearance Project for Risk Assessment

30. The MEH Working Group also initiated a Concept Study for Under-Keel-Clearance (UKC) for the SOMS in early 2013. The aim of the Concept Study was to assess the usefulness of a risk management tool to effectively plan and monitor the Under-Keel-Clearance (UKC) of deep draft ships like VLCCs transiting the SOMS. The Concept Study was funded by the IMO's Malacca and Singapore Straits Trust Fund. From the Concept Study, the Consultant made two recommendations:

a) To carry out multibeam hydrographic surveys in four selected areas that could affect UKC of deep draft vessels. The results of the survey would be used to produce larger scale and more detailed ENCs. These would complement existing ENCs of the SOMS. Together these ENCs would provide both coverage and detailed bathymetry for the UKC risk management application tools to highlight high risk areas.

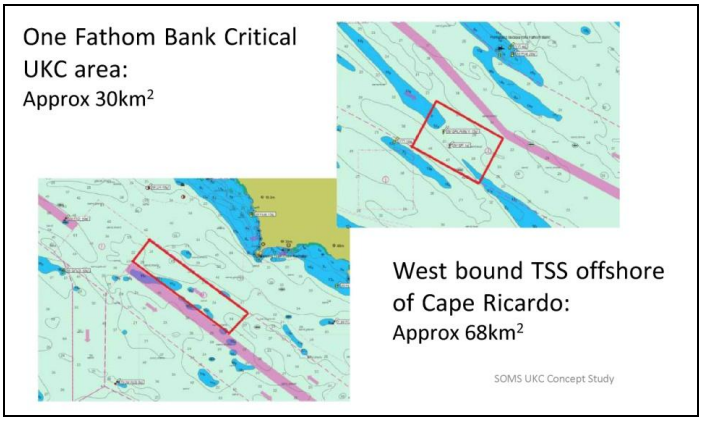

Fig 7 : Location of 4 areas selected for high resolution multibeam surveys

b) To carry out a test bed onboard ship to demonstrate the application tools to monitor the UKC using real time tidal information transmitted continuously through the AIS. The test bed would evaluate the usefulness of the system to monitor the 3.5 metres UKC SOMS requirement in dynamic mode by the three littoral States.

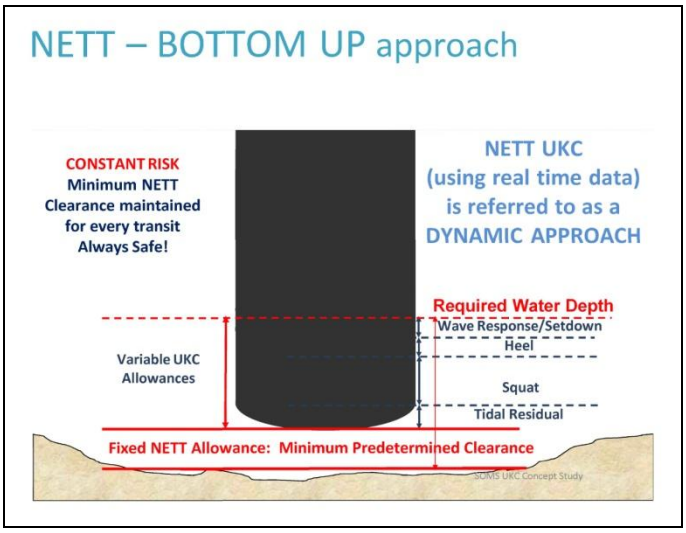

Fig 8 : Concept of Under-Keel-Clearance

c) The other advantage of the UKC monitoring tool is that it is a risk assessment tool which allows forward planning for ships to ascertain the amount of cargo to load at the preceding port(s) before it commits the ships into the SOM. Once in the SOMS it can closely monitor the UKC in the dynamic mode to ensure adherence to the UKC requirement for the SOM

d) The main and important benefit for shore authorities and coastal States would be the increased confidence that a risk management tool is in place for the safe passage of deep draught vessels using the SOMS.

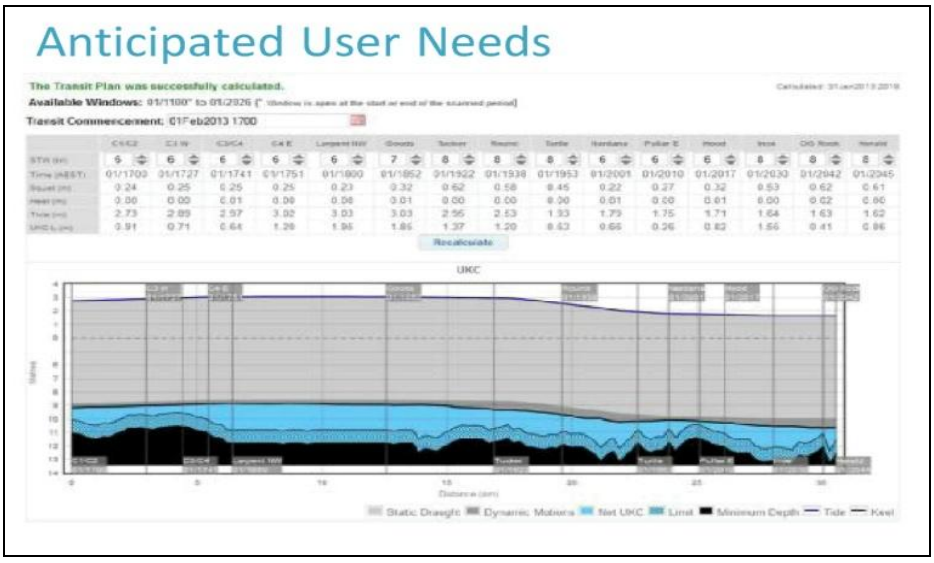

Fig 9 : Risks assessment tool to plan and monitor the UKC

31. Moving ahead, there are plans to extend the number of tidal gauges along the SOMS. With a network of tide gauges in place, ships would be able to receive continuous information through the SOMS. The coverage is shown below.

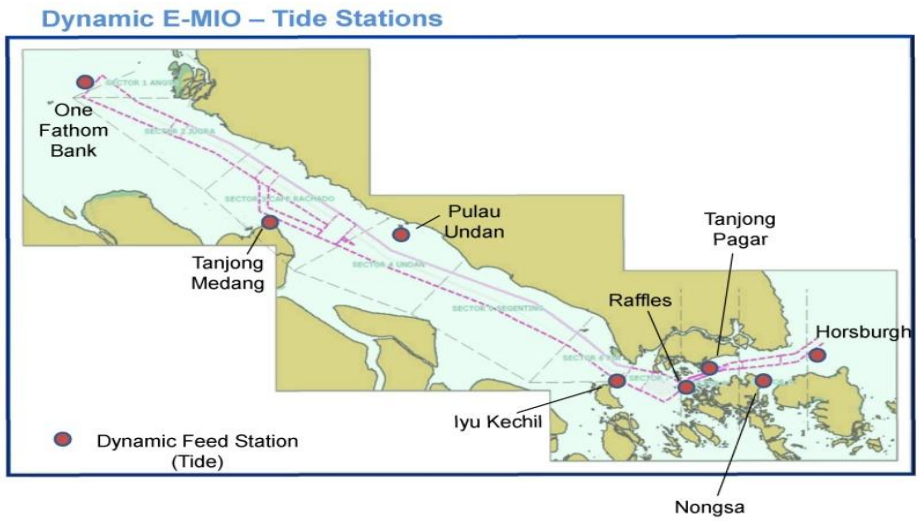

Fig 10 : Proposed location of tidal stations with real-time tidal data

Hydrographic Surveys of Critical Areas for Deep Draught Vessels

32. In order for the UKC tool for risk assessment to work effectively and efficiently, there is a need to ensure that the critical depth areas must be surveyed to modern standards ie. the multibeam sonar survey system. In this respect, the littoral States are discussing the details of the proposed

hydrographic surveys of the 4 critical areas along the traffic separation scheme (TSS) in the SOMS identified by the consultant. During discussion with the littoral States, an additional area in Singapore waters was identified, increasing the critical areas to be surveyed from 4 to 5, as shown below in the drawings below:

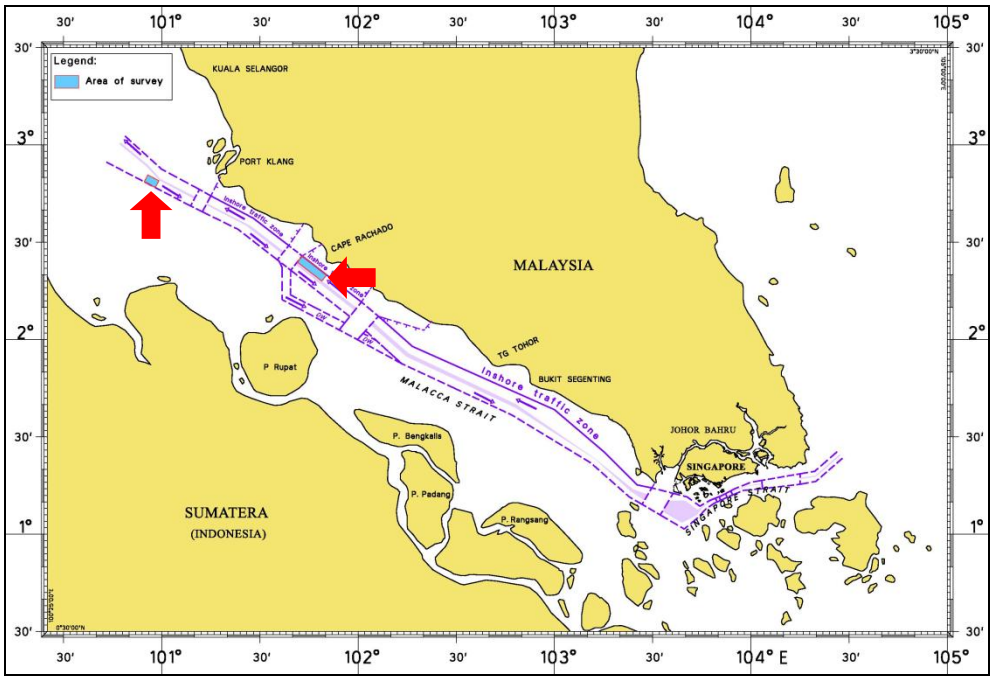

Fig 11: Proposed areas of survey in Malacca Strait

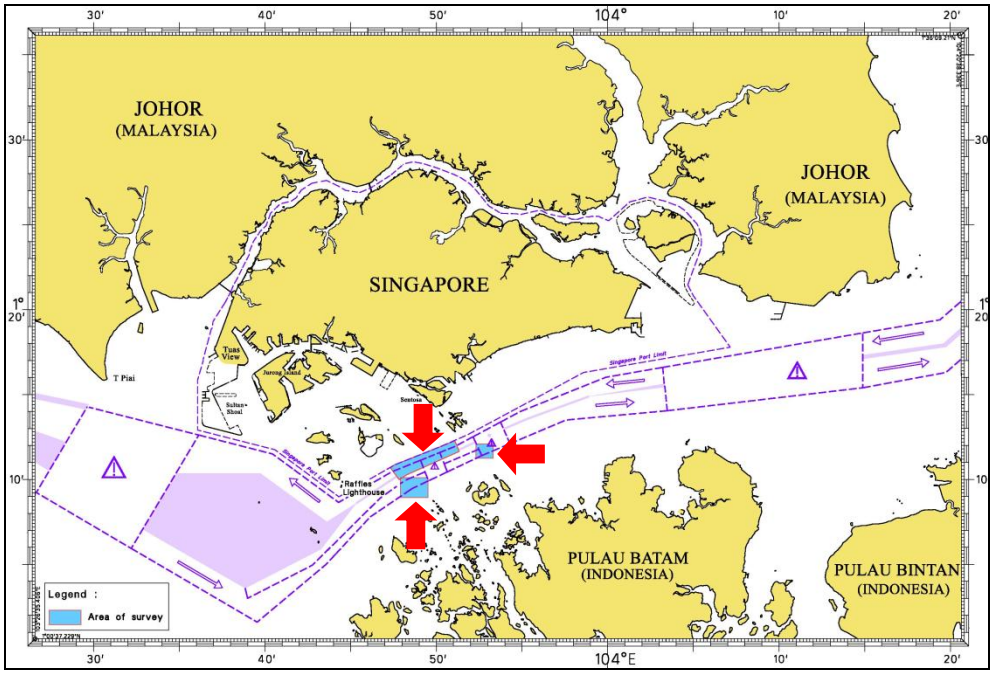

Fig 12 : Proposed areas of survey in Singapore Strait

Upon completion of survey of the 5 critical areas, the littoral States are considering the possibility of further extending the coverage to include the remaining areas within the TSS. The area to be surveyed would be much larger. Careful planning and funding support would be required.

Oil Spill / Hydrodynamics / Sand Waves Modelling

33. Following the One Fathom Bank hydrographic survey project, there is a need to carry out regular hydrographic surveys in order to ascertain the variance cause by seasonal effects. Hence, the regular hydrographic surveys need to be carried out over several monsoonal periods. It is a long journey but a necessary one to a better understanding on the changing environmental dynamics in sand wave areas. Surveys have to be carried out during the 2 monsoonal period to see the effects of seasonal change. The added information would enable better interpretation of the characteristics of the sand wave movements and other factors that may influence the changes.

34. Presently, there is no regional model developed for the SOMS. With more information on sand wave movements, there would be common platform among littoral States to use in deployment of resources to combat marine pollution.

Proposed Pilot Study on the use of enhanced RACON (eRACON) to complement GPS in Singapore

35. Recognising the need for accurate and reliable position information is critical to users, Singapore will carry out a pilot study of Enhanced RACON (eRacon) which uses the radar response of a RACON beacon to determine the vessel position. Utilising a series of these eRACON along the narrow and restricted waters, navigation safety could be enhanced. This secondary positioning system would backup primary navigation system like the GPS/DGPS in instances of failure and intentional spoofing/jamming of signals.

36. Under these circumstances, the use of eRACON to complement the primary positioning system of the vessel would enhance the navigational safety of the vessel.

CONCLUSION

37. The main lesson learnt from the MEH DP project is that commitment and cooperation among the littoral States, users and stakeholders are critical components for the success of the project. Besides establishing the infrastructure, longer term commitment is important to ensure sustainability as equipment and infrastructure require subsequent maintenance. In this regard, with the three

littoral States of Indonesia, Malaysia and Singapore agreeing to place the MEH as a permanent Working Group under the TTEG, it is testimony of their long term commitment to the MEH project.

38. The potential of the MEH is vast as it provides an essential framework for extra-regional involvement to contribute to the navigational safety and protection of the marine environment in the SOMS. The success of the MEH has a potential spin-off effect of encouraging further international cooperation in other major shipping lanes. For example, it is hoped that the MEH in SOMS could be further extended into the major sea lanes in the South China Sea, with relevant support. With the right window of opportunity, it would be an excellent showcase of regional cooperation to enhance navigational safety and the protection of the marine environment.

Submitted by : Singapore, with inputs from Indonesia and Malaysia
Date : 12 August 2014